TWIN DISC
INCORPORATED

Service Manual

Marine Transmission

Components:
MG-5145A

Document Number: 1021569

NOTICE

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October, 2004

Marine Transmission Service Manual

TWIN DISC, INCORPORATED
EXCLUSIVE LIMITED WARRANTY
MARINE PLEASURE CRAFT

A. Twin Disc, Incorporated warrants all assembled products and parts, (except component products or parts on which written warranties issued by the respective manufacturers thereof are furnished to the original customer, as to which Twin Disc, Incorporated makes no warranty and assumes no liability) against defective materials or workmanship *for a period of thirty-six (36) months from the date of original shipment by Twin Disc, Incorporated to the original customer, but not to exceed twenty-four (24) months of service, whichever occurs first.* **This is the only warranty made by Twin Disc, Incorporated and is in lieu of any and all other warranties, express or implied, including the warranties of merchantability or fitness for a particular purpose and no other warranties are implied or intended to be given by Twin Disc, Incorporated.** This warranty applies only to private, non-commercial (non-revenue earning) marine pleasure craft applications delivered by Twin Disc, Incorporated to the original customer on or after May 1, 1995.

The original customer does not rely upon any tests or inspections by Twin Disc, Incorporated or on Twin Disc, Incorporated*s application engineering. Twin Disc, Incorporated is not responsible for any specific application, installation of performance standard. Any analysis program by Twin Disc, Incorporated based upon customer supplied information is done solely as an accommodation to the customer and is not to be interpreted or construed as an approval for specific application or a guarantee of performance. Twin Disc, Incorporated cannot be held liable or responsible for incorrect information supplied or deviations from specifications provided by customer.

B. **The exclusive remedy provided by Twin Disc, Incorporated whether arising out of warranty within the applicable warranty period as specified, or otherwise (including tort liability), shall at the sole option of Twin Disc, Incorporated be either the repair or replacement of any Twin Disc, Incorporated part or product found by Twin Disc, Incorporated to be defective. For all models except MG340 and MG360 this include the labor to perform that work and to remove and reinstall (or equivalent credit). In this context, labor is defined as the flat rate labor hours established by Twin Disc, Incorporated in the published Twin Disc Flat Rate Schedule, required to remove, disassemble, inspect, repair, reassemble, reinstall and test the Twin Disc, Incorporated product only. Authorized reasonable travel and living expenses will be considered for payment in all model except MG340 and MG360. Under no circumstances, including a failure of the exclusive remedy, shall Twin Disc, Incorporated be liable for economic loss, consequential, incidental or punitive damages.** The above warranty and remedy are subject to the following terms and conditions:

1. Complete parts or products upon request must be returned transportation prepaid and also the claims submitted to Twin Disc, Incorporated within sixty (60) days after completion of the in-warranty repair.
2. The warranty is void if, in the opinion of Twin Disc, Incorporated, the failure of the part or product resulted from abuse, neglect, improper maintenance or accident.
3. The warranty is void if any modifications are made to any product or part without the prior written consent of Twin Disc, Incorporated.
4. The warranty is void unless the product or part is properly transported, stored and cared for from the date of shipment to the date placed in service.
5. The warranty is void unless the product or part is properly installed and maintained within the rated capacity of the product or part with installations properly engineered and in accordance with the practices, methods and instructions approved or provided by Twin Disc, Incorporated.
6. The warranty is void unless all required replacement parts or products are of Twin Disc origin or equal, and otherwise identical with components of the original equipment. Replacement parts or products not of Twin Disc origin are not warranted by Twin Disc, Incorporated.

C. As consideration for this warranty, the original customer and subsequent purchaser agree to indemnify and hold Twin Disc, Incorporated harmless from and against all and any loss, liability, damages or expenses for injury to persons or property, including without limitation, the original customer*s and subsequent purchaser*s employees and property, due to their acts or omissions or the acts or omissions of their agents, and employees in the installation, transportation, maintenance, use and operation of said equipment.

D. Only a Twin Disc, Incorporated authorized factory representative shall have authority to assume any cost or expense in the service, repair or replacement of any part or product within the warranty period, except when such cost or expense is authorized in advance in writing by Twin Disc, Incorporated.

E. Twin Disc, Incorporated reserves the right to improve the product through changes in design or materials without being obligated to incorporate such changes in products of prior manufacture. The original customer and subsequent purchasers will not use any such changes as evidence of insufficiency or inadequacy of prior designs or materials.

F. If failure occurs within the warranty period, and constitutes a breach of warranty, repair or replacement parts will be furnished on a no-charge basis and these parts will be covered by the remainder of the unexpired warranty which remains in effect on the complete unit.

TWIN DISC, INCORPORATED
FLAT RATE HOUR ALLOWANCE
MARINE PLEASURE CRAFT

(Hourly Labor Rates Must Be Acceptable to Twin Disc, Incorporated)

MODEL SERIES	R&R	UNIT REBUILD
MG340, MG360	0.0	0.0
MG502, MG5010, MG5011, MG5005A, MG5015A	10.0	8.0
MG506, MG5050, MG5061, MG5062, MG5055A	10.0	11.0
MG507, MG5081, MG5085, MG5090, MG5091	10.0	12.0
MG509, MG5111, MG5112, MG5114	10.0	17.0
MG514C, MG5141	10.0	25.0
MG5202, MG5203, MG5204, MG5222 MG5225	10.0	32.0
MG6000	10.0	32.0
MGN80, MGN232, MGN233, MGN272, MGN273, MGN332, MGN334, MGN335, MGN432, MGN433, MGN472, MGN493	10.0	32.0
PUMP - ALL MODELS EXCEPT MG340 & MG360	1.0	-
VALVE - ALL MODELS EXCEPT MG340 & MG360	1.0	.5

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Introduction

General Information

This publication provides service information for the Twin Disc MG-5145A marine transmission. Specific engineering details and performance characteristics can be obtained from the Product Service Department of Twin Disc, Incorporated, Racine, Wisconsin, USA.

Operation and maintenance personnel responsible for this equipment should be familiar with this publication and have it at their disposal. A thorough understanding and application of the material in this manual will result in consistent performance from the unit and help reduce downtime.

Safety and General Precautions

General

All personnel servicing this equipment should employ safe operating practices. Twin Disc, Inc. will not be responsible for personal injury resulting from careless use of hand tools, lifting equipment, power tools, or unacceptable maintenance/ working practices.

Important Safety Notice

Proper installation, maintenance, and operation procedures must be followed due to the possible danger to person(s) or property from accidents that may result from the use of machinery. Twin Disc, Inc. will not be responsible for personal injury resulting from careless maintenance/working practices.

Inspect as necessary to assure safe operations under prevailing conditions. Proper guards and other safety devices that may be specified in safety codes should be provided. These devices are neither provided by, nor are they the responsibility of Twin Disc, Inc.

⚠ WARNING

Selecting NEUTRAL disengages transmission clutches but does not prevent propeller shaft rotation. If you require positive neutral (propeller shaft locked), a shaft brake or other shaft-locking device must be used.

⚠ WARNING

To prevent accidental starting of the engine when performing routine transmission maintenance, disconnect the battery cables from the battery and remove ignition key from the switch.

⚠ WARNING

Most Twin Disc products have provisions for attaching lifting bolts. The holes provided are always of adequate size and number to safely lift the Twin Disc product. These lifting points must not be used to lift the complete power unit. Lifting excessive loads at these points could cause failure at the lift point (or points) and result in damage or personal injury.

⚠ CAUTION

Select lifting eyebolts to obtain maximum thread engagement with bolt shoulder tight against housing. Bolts should be near but should not contact bottom of bolt hole.

Preventative Maintenance

Frequent reference to the information provided in the Marine Transmission Owner's Manual, 1016313, regarding daily operation and limitations of this equipment will assist in obtaining trouble-free operation. Schedules are provided for recommended maintenance of the equipment.

Towing

⚠ WARNING

Under the conditiions described below, the prop shaft must be locked in place to prevent backdriving. Failure to do this can damage the marine transmission due to lack of component lubrication

Backdriving (also called windmilling) occurs when an engine is shut down and the propeller shaft is being driven by the flow of water across the propeller, which, in turn, rotates the components in the marine transmission. During backdriving conditions, the transmission does not receive proper lubrication.

Conditions where backdriving may occur:

- ❑ Vessel is being towed.
- ❑ One or more engines on a multiple-transmission vessel are shut down while under way.
- ❑ Sailboat under sail with auxiliary engine shut down.
- ❑ Vessel tied up or docked in a heavy current.

Any of the following solutions are applicable if any of the above conditions are present:

- ❑ Lock the propeller shaft to prevent rotation.
- ❑ Add an optional trailing oil pump into the lubrication circuit.

Refer to the hydraulic system schematics for more details on the optional trailing pump specifications for the applicable transmission, or contact your Twin Disc Authorized Distributor.

Ordering Parts and Obtaining Services

⚠ WARNING

All replacement parts or products (including hoses and fittings) must be of Twin Disc origin or equal, and otherwise identical with components of the original equipment. Use of any other parts or products will void the warranty and may result in malfunction or accident, causing injury to personnel and/or serious damage to the equipment.

Ordering Service Parts

Renewal parts, service parts kits, optional equipment and product service assistance may be obtained from any authorized Twin Disc distributor or service dealer. Contact Twin Disc for the distributor or service dealer near you.

Note: Do not order parts using the part numbers on the cross-sectional drawings. These numbers may be referenced for part identification; however, they should be verified on the bill of material (BOM) before an order is placed. BOM numbers are stamped on the unit nameplate.

Twin Disc, having stipulated the bill of material number on the unit's nameplate, absolves itself of any responsibility resulting from any external, internal, or installation changes made in the field without the express written approval of Twin Disc. All returned parts, new or old, resulting from any of the above stated changes will not be accepted for credit. Furthermore, any equipment that has been subjected to such changes will not be covered by a Twin Disc warranty.

Source of Service Information

For the latest service information on Twin Disc products, contact any Twin Disc distributor or service dealer. This can be done on the Twin Disc corporate web site found at [http://www.twindisc.com]. Provide your model number, serial number and bill of material number to obtain information on your unit. If necessary, contact the Product Service Department, Twin Disc, Incorporated, Racine, Wisconsin 53405-3698, USA by e-mail at service@twindisc.com.

Warranty

Equipment for which this manual was written has a limited warranty. For details of the warranty, refer to the warranty statement at the front of this manual. For details of the warranty, contact any Twin Disc Authorized Distributor, service dealer, or the Warranty Administration Department, Twin Disc, Inc., Racine, Wisconsin, U.S.A.

NOTES

Description and Specifications

General

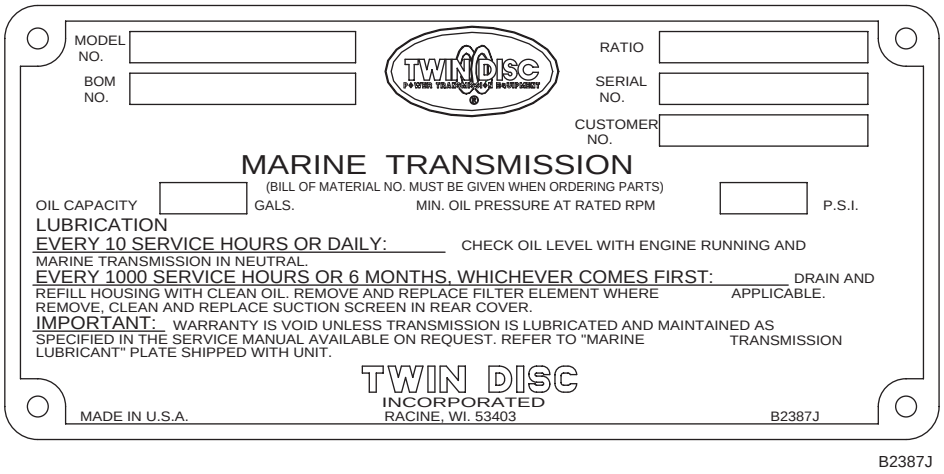
The MG-5145A is a reverse and reduction Marine Transmission. This transmission has a 10° down-angle for near level engine installation, offer conical gearing for quieter operation, and are available in the following ratios:1.26:1, 1.48:1, 1.75:1, 1.96:1 and 2.50:1.

The MG-5145A transmission is controlled by hydraulics. Both the primary and secondary clutches are operated by main pressure oil supply. The bearings, clutches and gears are lubricated and cooled with low pressure oil.

Drawing PX-10830 identifies the installation information for the MG-5145A marine transmission.

Nameplate

The nameplate identifies the model, bill of material (BOM) and the serial number of the unit. These numbers are necessary to identify the correct parts for your transmission.


MODEL NO.
BOM NO.
TWIN DISC
RATIO
SERIAL NO.
CUSTOMER NO.
MARINE TRANSMISSION
(BILL OF MATERIAL NO. MUST BE GIVEN WHEN ORDERING PARTS)
OIL CAPACITY
GALS.
MIN. OIL PRESSURE AT RATED RPM
P.S.I.
LUBRICATION
EVERY 10 SERVICE HOURS OR DAILY: CHECK OIL LEVEL WITH ENGINE RUNNING AND MARINE TRANSMISSION IN NEUTRAL.
EVERY 1000 SERVICE HOURS OR 6 MONTHS, WHICHEVER COMES FIRST: DRAIN AND REFILL HOUSING WITH CLEAN OIL. REMOVE AND REPLACE FILTER ELEMENT WHERE APPLICABLE.
REMOVE, CLEAN AND REPLACE SUCTION SCREEN IN REAR COVER.
IMPORTANT: WARRANTY IS VOID UNLESS TRANSMISSION IS LUBRICATED AND MAINTAINED AS SPECIFIED IN THE SERVICE MANUAL AVAILABLE ON REQUEST. REFER TO "MARINE TRANSMISSION LUBRICANT" PLATE SHIPPED WITH UNIT.
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RACINE, WI. 53403
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Figure 1. Example of MG-5145A Nameplate

Power Ratings

The MG-5145A transmission can be operated through either the primary shaft or secondary shaft at its full rated horsepower when driven by a standard right hand rotation engine (counterclockwise flywheel rotation ditrection when viewing rear of engine).

Always reference the Bill of Materials (BOM) or Specification number when ordering service parts.

Changing Rotation

When shipped form the factory, each unit is designated for use with a particular engine rotation. Within their rated capacities, these units may be operated continuously in either forward or reverse.

The unit can be adapted to either left or right-hand engine rotation. To adapt to opposite engine rotation, remove the heat exchanger hose from the rear end of the pump. Remove the pump, turn it 180° and reinstall it. Remove the plug from the rear of the pump and install where the heat exchanger hose was. Install the heat exchanger hose where the plug was. When changing from RH rotation to LH rotation install an engine rotation plate (Arrow) to indicate the new direction of rotation.

Direction of Drive

The primary (input) clutch shaft and driving transfer gear always rotates in engine direction. The secondary clutch shaft and driven transfer gear always rotate in anti-engine direction because the driven transfer gear is meshed with the driving transfer gear on the primary clutch shaft. When the primary clutch is engaged, the primary input pinion rotates in engine direction. The output gear, which is secured to the output shaft, is meshed with the primary input pinion and so the output gear and shaft are driven in anti-engine direction. When the secondary clutch is engaged, the secondary input pinion rotates in anti-engine direction. The output gear is meshed with the secondary input pinion and, therefore, the output gear and shaft are driven in engine direction.

Construction Features

Housings

The MG-5145A housing consists of a front SAE 0 or SAE 1 housing and a rear half housing. They are sealed together with a gasket.

Taper Roller Bearings

The primary and secondary clutch shafts are supported and located by tapered roller bearings. The pinions are supported on bushings and the end movement limited by thrust washers. Bearing clearances for each clutch shaft are set by use of a single shim pack at the rear-tapered roller bearing on each shaft. Tapered roller bearings and a spherical roller bearing support the output shaft and have bearing clearance adjusted by use of shims at the front bearing retainer.

Oil Pump Drive

The oil pump is tang-connected and driven by the secondary clutch shaft.

Lubrication Features

The MG-5145A transmission bearings and clutches on the primary and secondary shafts are lubricated through oil passages drilled in the shafts. The output shaft bearing, transfer gears, primary and secondary pinions and their bearings are gravity and splash lubricated.

Suction Strainer

The marine transmission has a serviceable suction strainer located below the oil pump. The strainer is between the sump and the oil pump in the hydraulic circuit. The strainer can be replaced if necessary.

Oil Filter Assembly

A spin-on oil filter is a standard feature on some MG-5145A transmissions. The filter is located between the heat exchanger outlet and the selector valve in the hydraulic circuit. The replacement element should be replaced at 1000 hours or six-month intervals, whichever comes first. The replacement filter part number is PM11652.

Gears

All gears are helical, carburized, hardened and ground for smooth quiet operation. All gears are in constant mesh. The primary and secondary transfer gears and the output gear are mounted on keyless tapers.

Flexible Torsional Input Coupling

The purpose of the torsional coupling is to transmit power from the engine to the marine transmission through a rubber or silicone element that will:

- ❑ Dampen torsional vibrations
- ❑ Change the natural frequencies of a system to move critical frequencies out of the operating speed range
- ❑ Accommodate a certain amount of misalignment
- ❑ Absorb shock and reduce noise
- ❑ Minimize gear “rattle”

Several couplings are available from Twin Disc, and are selected based on the customer supplied engine information. Final coupling selection must be confirmed by the packager based on the torque/rpm ratings and the results of the system torsional vibration analysis (TVA), and on engine rotation. Care must be taken when servicing that replacement couplings are matched to this criteria.

Heat Exchanger

The heat exchanger is designed to maintain the oil in the hydraulic system of the marine transmission at the proper temperature by passing coolant from the engine through the heat exchanger. The heat exchanger is mounted on a special bracket bolted on the live PTO face. The special brackets allow either live PTO connection or clutchable PTO and no PTO as well. In case of remote mounting, the heat exchanger should be installed in a location convenient to both engine coolant and marine transmission oil.

Table 1. Heat Exchanger Requirements

HEAT EXCHANGER (H.E.) REQUIREMENTS			
PERMISSIBLE OIL TEMPERATURE INTO HEAT EXCHANGER			
RATIO	OIL VISCOSITY	MAX.	MIN.
ALL RATIOS	SAE 30	85˚C(185˚F)	65˚C(150˚F)
ALL RATIOS	SAE 40	99˚C(210˚F)	80˚C(175˚F)
MIN. HEAT TRANSFER CAPACITY (APPLY APPROPRIATE SERVICE FACTOR FOR FRESH AND RAW WATER)	KW(BTU/MIN) PER ENGINE RTD. H.P.		
	CONTINUOUS DUTY .026(1.484)	P.C. & INT. DUTY .022(1.272)	
APPROX. OIL FLOW TO H.E.	2.3 L/MIN(.61 GPM) PER 100 ENGINE R.P.M.		
PEAK OIL PRESSURE AT H.E. (PROOF TEST H.E. AT 1,5 X KPa(PSI)	1965 KPa(285 PSI)		
MAX. ALLOWABLE OIL PRESSURE DROP ACROSS H.E. WITH 66mm ^{2}/sec (300 SUS) OIL AT RATED ENGINE R.P.M	207 KPa (30 PSI)		
WATER FLOW TO H.E. - USE 1.5 TO 3.0 TIMES OIL - L/MIN.(GPM)			
H.E. WATER PRESSURE RATING, MIN., = 1.5 X H.E. INLET WATER KPa(PSI)			
DATA H.E. PURCHASER MUST ALSO TELL VENDOR			
STATE IF RAW (OPEN CHANNEL & SEA) OR FRESH (CLOSED ENGINE JACKET * AND/OR KEEL COOLER) WATER WILL COOL H.E.			
STATE MAX. WATER TEMP. INTO H.E. -- TYPICAL: RAW WATER - 29˚C-32˚C (85˚F-90˚F), KEEL COOLER WATER 46˚C-60˚C(115˚F-140˚F), ENGINE JACKET WATER* 74˚C-85˚C(165˚F-185˚F).			
STATE MIN., ALSO MAX. L/MIN. (GPM) OF WATER FLOW TO H.E.			
H.E. INSTALLATION & SERVICE REQUIREMENTS			
OIL LINES, TRANSMISSION TO H.E. AND RETURN ---- (1) MAX. VELOCITY IN FITTINGS,PIPE,HOSE AND TUBES-7,6m/sec (25FT./SEC.) (2) BURST PRESSURE, MIN., = 10 x PEAK OIL PRESSURE AT H.E. (3) HOSE - SAE J517 100R1 MEETING USCG 46CFR 56.60-25(C),135˚C (275˚F) TEMP. RATING (4) PROTECT LINES FROM MECHANICAL DAMAGE. ZINC ANODES PROTECT H.E. RAW WATER PASSAGES FROM CORROSION. CHECK & REPLACE THEM FREQUENTLY.			

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Specifications and Maintenance

Frequent reference to this data and application of the information will result in better service from the transmission.

Oil Capacity

13.25 Liters (3.50 US Gal.) less hoses and heat exchanger.
The transmission should be warmed to operating temperature when oil is checked.

Oil Pump Capacity

14.1 GPM @ 1800 RPM.

Minimum Oil Pressure When Cruising

Check your unit's identification plate. MG-5145A has a minimum oil pressure at rated engine RPM, located on the name plate, of 1655kPa (240 psi) non trolling mode.

Maximum Input Speed

2500 RPM.

Dry Weight

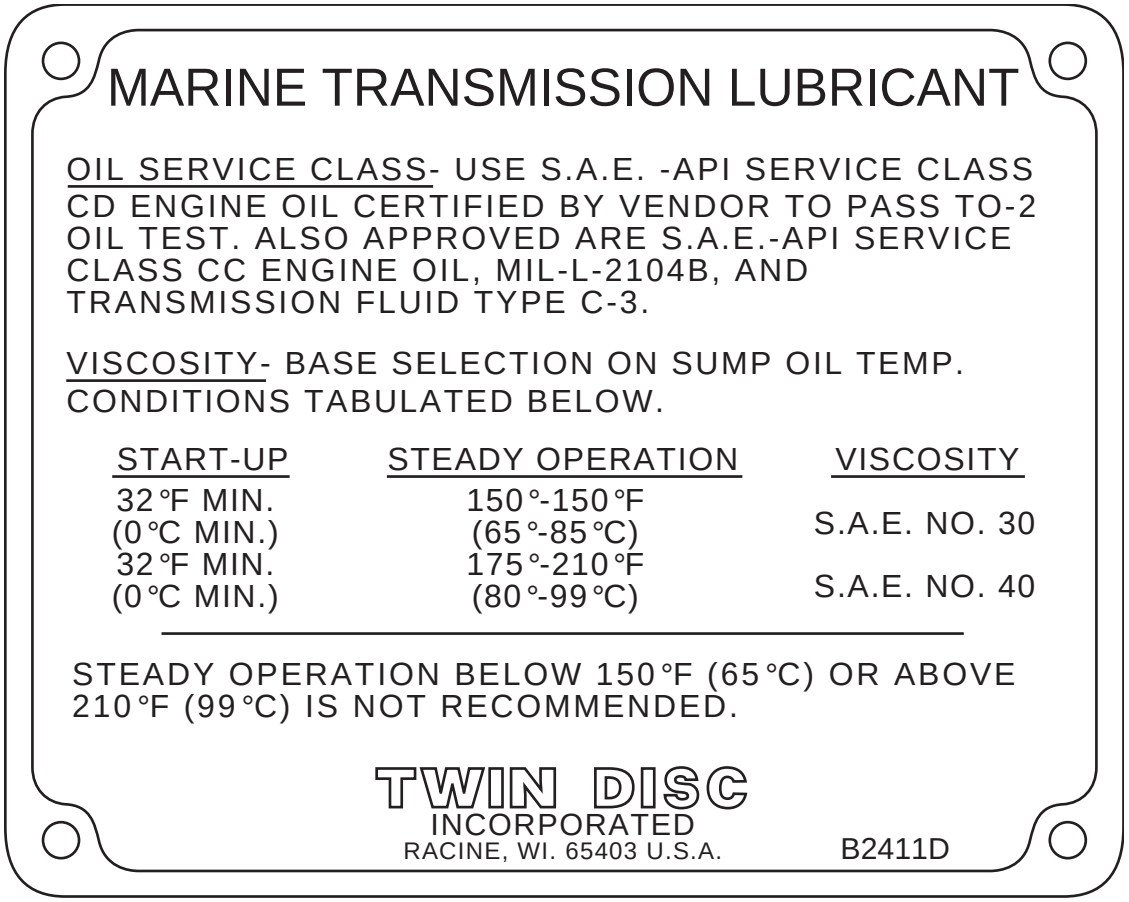
Approximately 320 Kg (705 lbs).

Type of Oil and Oil Viscosity

Note: Multi-viscosity oils (i.e. 10W-20 etc.) should not be used in Twin Disc MarineTransmissions.

The recommended oil is mentioned on the lubricant nameplate located on the housing of your Marine Gear.

Table 2. Marine Transmission Lubricant


MARINE TRANSMISSION LUBRICANT
OIL SERVICE CLASS- USE S.A.E. -API SERVICE CLASS CD ENGINE OIL CERTIFIED BY VENDOR TO PASS TO-2 OIL TEST. ALSO APPROVED ARE S.A.E.-API SERVICE CLASS CC ENGINE OIL, MIL-L-2104B, AND TRANSMISSION FLUID TYPE C-3.
VISCOSITY- BASE SELECTION ON SUMP OIL TEMP. CONDITIONS TABULATED BELOW.
START-UP
STEADY OPERATION
VISCOSITY
32°F MIN. (0°C MIN.)
150°-150°F (65°-85°C)
S.A.E. NO. 30
32°F MIN. (0°C MIN.)
175°-210°F (80°-99°C)
S.A.E. NO. 40
STEADY OPERATION BELOW 150°F (65°C) OR ABOVE 210°F (99°C) IS NOT RECOMMENDED.
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Oil Pressures

The following tables give oil pressures at different speeds and ranges. Check your unit's identification plate for the "Minimum Oil Pressure When Cruising". Use this value to determine which table applies to your unit. See MG-5145A-rear view for location of oil pressure checkpoints.

Table 3. 1725 kPa (250 psi) Transmission Oil Pressure Specifications

Control Valve - 1725 kPa (250 psi) Springs									
Input Speed	Shift Position	Main Pressure at Valve Inlet		Primary Clutch Min.		Secondary Clutch Min.		Lube	
		kPa	psi	kPa	psi	kPa	psi	kPa	psi
600	Neutral	255-310	37-45	0	0	0	0	19 min	2.8 min
600	Primary	1586-1827	230-265	1696	246	0	0	19 min	2.8 min
600	Secondary	1586-1827	230-265	0	0	1696	246	19 min	2.8 min
2100	Neutral	276-690	40-100	0	0	0	0	193-586	28-100
2100	Primary	1725-1931	250-280	1558	226	0	0	193-586	28-100
2100	Secondary	1725-1931	250-280	0	0	1558	226	193-586	28-100

Note: It is required that primary and secondary clutches must be within 21 kPa (3 psi) of each other.

Table 4. Limits for Marine Transmission Equipped with Hydraulic Clutched PTO

Limits for Marine Transmission Equipped with Hydraulic Clutched PTO									
Input rpm	PTO Control Valve Disengaged		Actual		PTO Control Valve Engaged		Actual		
	kPa	psi	kPa	psi	kPa	psi	kPa	psi	
600	0	0			1724-1862	250-270			Transmission Control Valve Engaged
1800	0	0			1758-1896	255-275			
600	0	0			1655-1793	240-260			Transmission Control Valve Disengaged
1800	0	0			1689-1827	245-265			
Note: Transmission control valve is the right valve and the PTO valve is the left valve, when viewed the rear of the transmission.									

Note: Some early production units operated with lower oil pressures. The following table applies to these units only.

Table 5. 1586 kPa (230 psi) Transmission Oil Pressure Specifications

Limits for Marine Transmission Equipped with Control & Trolling Valve with 1586 kPa (230 psi) Spring									
Shift (900 rpm)	Primary			Secondary			Cooling		
	Min. kPa (psi)	Actual kPa (psi)	Max. kPa (psi)	Min. kPa (psi)	Actual kPa (psi)	Max. kPa (psi)	Min. kPa (psi)	Actual kPa (psi)	Max. kPa (psi)
Primary	138 (20)		483 (70)	0 (0)		0 (0)	55 (8)		138 (20)
Secondary	0 (0)		0 (0)	138 (20)		483 (70)	55 (8)		138 (20)
Neutral	0 (0)		0 (0)	0 (0)		0 (0)	55 (8)		138 (20)
Note: With trolling at its "minimum" trolling pressure position, primary, secondary, and cooling pressures must be per chart above at both input and shift specified. Readjust with shims, to achieve primary and secondary pressures specified.									

Note: It is required that primary and secondary clutches must be within 21 kPa (3 psi) of each other.

Table 6. 2415 kPa (350 psi) Transmission Oil Pressure Specifications

Limits for Marine Transmission Equipped with 2415 kPa (350 psi) Proportional Valves												
rpm	Range	Valve Inlet			Primary		Secondary		Lube			Cooling Temp. °C °F
		Min. kPa (psi)	Act. kPa (psi)	Max. kPa (psi)	Min. kPa (psi)	Act. kPa (psi)	Min. kPa (psi)	Act. kPa (psi)	Min. kPa (psi)	Act. kPa (psi)	Max. kPa (psi)	
1800	Primary	1725 (250)		1931 (280)	1696 (246)		0 (0)		207 (30)		345 (50)	
	Secondary	1725 (250)		1931 (280)	0 (0)		1696 (246)		207 (30)		345 (50)	
	Neutral	1725 (250)		1931 (280)	0 (0)		0 (0)		207 (30)		414 (60)	
600	Primary	1586 (230)		1827 (265)	1558 (226)		0 (0)		14 (2)		55 (8)	
	Secondary	1586 (230)		1827 (265)	0 (0)		1558 (226)		14 (2)		55 (8)	
	Neutral	1586 (230)		1827 (265)	0 (0)		0 (0)		28 (4)		83 (12)	
Cooling temperature range: Delvac 1110 Oil at 29-35°C (85-95°F) or Mobilkote 501 at 32-38°C (90-100°F) Required: Primary lube pressure = secondary lube pressure within 21 kPa (3 psi) ALL SHIFTS MUST BE DONE AT OR BELOW 1800 RPM												

Optional Equipment

The following optional equipment is available for the MG-5145A marine transmission (except where noted) through the nearest authorized Twin Disc distributor.

Power Take-off

A live power take-off pump mount is available in sizes SAE J-744 No. 127-4 and SAE J-744 No. 32-4 (SAE “C”, 4-bolt).

A clutchable pump mount power take-off is available in sizes SAE J-744 No. 127-4 and SAE J744 No. 32-4.

A clutchable shaft drive power take-off is available.

PTO adapter from SAE J-744 size 127-4 to 101-4 (SAE “C” to SAE “B”).

Mounting Brackets

Steel fabricated mounting brackets for rigid mounting are available.

Torsional Input Coupling

Several models of torsional input couplings are available, including Silicon Vulkan (VKE) and Centa (CF-R).

Oil Filter

A spin-on oil filter is available for MG-5145A models that are not equipped with a standard oil filter. It is located between the heat exchanger outlet and control valve in the hydraulic circuit.

Heat Exchanger

A heat exchanger is available, shipped loose or mounted.

Companion Flange Assembly

The companion flange assembly consists of the companion flange and mounting hardware.

Mechanical Control Valve

A mechanical control valve is available.

Electric Control Valve

An electric control valve is available for either 12 VDC or 24 VDC actuating solenoids.

GP Control Valve with Electronic Interface

There is also a GP valve assembly available for models with optional input and output speed pickups mounted on the transmission.

Trolling Valve

Mechanical and electrical trolling valves are available.

Table 7. Bearing End Play Specifications

Transmission Primary and Secondary Shaft Tapered Roller Bearing Endplay		
Assembly No.	**Minimum**	**Maximum**
All	0.00 mm (0.000 in)	+0.07 mm (+0.003 in)
Transmission Output Shaft Bearing Endplay		
Assembly No.	**Minimum**	**Maximum**
All	0.00 mm (0.000 in)	+0.05 mm (+0.002 in)

Note: A negative endplay indicates a pre-load condition.

Table 8. Front housing and Output Flange Runout Limits

Feature	Maximum allowable total indicator reading
SAE #1 front housing face	0.25 mm (.010 in.)
SAE #0 front housing face	0.30 mm (.012 in.)
SAE #1 front housing pilot diameter	*0.30 mm (0.012 in.)
SAE #0 front housing pilot diameter	*0.41 mm (0.016 in.)
Output flange face near O.D.	0.10 mm (0.004 in.)
Output flange pilot diameter	0.10 mm (0.004 in.)

*This note applies to a continuous 270° arc if the balance of the pilot is negative in readings; otherwise it means all 360°.

Table 9. Ouput Gear Advance

Minimum	Actual	Maximum
3.81 mm (0.150 in.)		5.33 mm (0.210 in.)

Table 10. Transfer Gear Advance

Shaft	Minimum	Actual	Maximum
Primary	4.19 mm (0.165 in.)		5.71 mm (0.225 in.)
Secondary	4.19 mm (0.165 in.)		5.71 mm (0.225 in.)

Torque Values for Fasteners

Note: Lubricate all threads and bearing face with light oil film prior to assembly.

Note: Use grade 5 and Property Class 8.8 specs when threading into aluminum.

Table 11. Metric Coarse Thread Capscrews, Bolts, and Nuts

Thread Size	Property Class 8.8		Property Class 10.9		Property Class 12.9	
	lb-ft	Nm	lb-ft	Nm	lb-ft	Nm
M6	6.5 - 7.5	9 - 10	9 - 10	12 - 14	10 - 12	14 - 16
M8	16 - 18	21 - 25	23 - 26	31 - 35	25 - 29	34 - 40
M10	32 - 36	43 - 49	44 - 51	60 - 68	51 - 59	70 - 80
M12	55 - 63	74 - 86	77 - 88	104 - 120	89 - 103	121 - 139
M16	132 - 151	179 - 205	189 - 217	256 - 294	219 - 253	298 - 342
M20	257 - 295	348 - 400	364 - 418	493 - 567	429 - 493	581 - 669
M24	445 - 511	603 - 693	626 - 720	848 - 976	737 - 848	1000 - 1150
M30	714 - 820	987 - 1113	1235 - 1421	1674 - 1926	1475 - 1697	2000 - 2301

Table 12. Metric Stainless Steel Capscrews, Bolts, and Nuts

Note: The use of nickel anti-seize compound is required to prevent corrosion due to galvanic action. Apply nickel anti-seize compound to the threads of these stainless steel fasteners before torquing to specification. See Standard Sheet S574B for a more complete listing of stainless steel fastener torque values.

Metric Coarse Thread Stainless Steel Capscrews, Bolts, and Nuts	
Thread Size	**Recommended Torque N-m (Lb$_f$-ft)**
M8	12 (8.5)
M10	24 (18)
M12	40 (30)
M14	63 (46)
M16	97 (72)

T-17

Table 13. Tapered Pipe Plugs (with thread lubricant)

Torque Values for Lubricated Pipe Plugs Recommended Torque in N-m (Lb$_f$-ft)			
PT Size	**NPTF** Size	**Installed in Cast Iron or Steel**	**Installed in Aluminum**
1/16 - 28	1/16 - 27	11.5 ± 1.3 (8.5 ± 1.0)	7.5±0.9 (5.5±0.7)
1/8 - 28	1/8 - 27	14.2 ± 1.8 (10.5 ± 1.3)	8.8 ± 1.1 (6.5 ± 0.8)
1/4 - 19	1/4 - 18	34 ± 4 (25 ± 3)	22 ± 3 (16 ± 2)
3/8 - 19	3/8 - 18	37 ± 4 (27 ± 3)	23 ± 3 (17 ± 2)
1/2 - 14	1/2 - 14	68 ± 8 (50 ± 6)	41 ± 5 (30 ± 4)
3/4 - 14	3/4 - 14	73 ± 10 (54 ± 7)	46 ± 5 (34 ± 4)
1 - 11	1 - 11-1/2	109 ± 13 (80 ± 10)	68 ± 8 (50 ± 6)
1-1/4 - 11	1-1/4 - 11-1/2	115 ± 13 (85 ± 10)	75 ± 9 (55 ± 7)
1-1/2 - 11	1-1/2 - 11-1/2	115 ± 13 (85 ± 10)	75 ± 9 (55 ± 7)

Notes:

The lubricant is to be John Crane insoluble plastic lead seal No. 2 (or equivalent), or Loctite® No. 92 (or equivalent) and plugs are to be capable of removal without damage. Overtightening may cause initial leakage, plus potential removal damage.

An option of a maximum of two full turns after finger tightening the plug may be used if required and if removal conditions are met.

T-12

Table 14. Straight Threaded Tube Fittings, Hose Fittings, and O-ring Plugs

Nominal Thread Diameter	Nm + or - 5 %	lb-ft + or - 5 %	Nominal Thread Diameter	Nm + or - 5 %	lb-ft + or - 5 %
5/16	5	3.5	1 5/8	108	80
3/8	11.5	8.5	1 7/8	108	80
7/16	16	12	2 1/2	108	80
1/2	20	15	M10X1.0	12	9
9/16	24	18	M12X1.5	16	12
5/8	24	18	M14X1.5	20	15
11/16	34	25	M16X1.5	24	18
7/8	54	40	M18X1.5	34	25
1 1/16	75	55	M22X1.5	54	40
1 3/16	88	65	M27X2.0	75	55
1 1/4	88	65	M33X2.0	88	65
1 5/16	108	80	M42X2.0	108	80
1 3/8	108	80	M48X2.0	108	80

Table 15. Tubing Nuts

Torque Values for Tubing Nuts	
Nominal Tube Size	**Recommended Torque N-m (Lb$_f$-ft)**
8 mm	39 (29)
10 mm	52 (38)
12 mm	62 (46)
15 mm	103 (76)
21.7 mm	118 (87)

T-13

Table 16. Banjo Fittings & Sealing Plugs with Copper Washers

Torque Values for Banjo Fittings & Sealing Plugs with Copper Washers	
Thread Size	**Recommended Torque N-m (Lb$_f$-ft)**
M14 x 1.5	64 (47)
M16 x 1.5	83 (61)
M24 x 1.5	186 (137)

T-16

Clutch Plate Wear Limits

Clutch steel plates:

Minimum thickness: 2.3 mm (0.091 in.)

Clutch friction plates:

Minimum thickness: 3.1 mm (0.122 in.)

Operation

General

The control valve obtains primary, neutral and secondary positions. When these positions are selected, the control valve directs high-pressure oil through internal passages to operate the clutches. The pressure-rate control piston within the control valve assembly provides a rapid, smooth, oil pressure increase in the hydraulic system during clutch engagement.

There are several control valves available for the MG-5145A. These will be discussed individually.

Hydraulic System with PX-9975 Series Manual Control Valve

The oil pump draws oil through the strainer from the oil sump and discharges it through the oil filter (if equipped). Filtered oil enters the control valve through the inlet port. The incoming oil forces the pressure regulator piston against the springs to open the path to the lubrication circuit. Oil not used for clutch engagement flows past the regulator piston to become lubrication oil. Lubrication oil flows through the heat exchanger to the lubrication oil circuit in the transmission to lubricate and cool the clutches and bearings. There is a lubrication oil pressure relief valve to limit maximum lubrication oil pressure to approximately 690 kPa (100 psi).

In Neutral, the inlet port of both clutches is connected to the atmosphere. Since the area behind the clutch pistons is open to sump, the clutches are disengaged. Oil is distributed through the lubrication system. The area between the pressure regulating piston and the rate-of-rise piston is connected through an orifice at all times. The pressure in the rate of rise cavity increases until it reaches the neutral regulated pressure as determined by the neutral regulator spring behind the ball. The passage behind the spring is connected to sump in neutral.

When the control valve is shifted to engage either clutch, the valve directs main pressure to engage the selected clutch pack. Oil is also directed to the neutral regulator spring cavity, seating the ball, preventing the flow of oil from the rate of rise cavity. Oil flows through the orifice, compressing the regulator springs. This progressively increases the clutch engaging pressure causing the clutches to engage at a controlled rate.

The control valve allows only one clutch to be engaged at a time, and the oil from the disengaged clutch is vented to sump (atmospheric pressure). The clutch return springs overcome any centrifugal head that may exist behind the piston, and move the disengaged clutch’s piston to the disengaged position minimizing clutch plate drag.

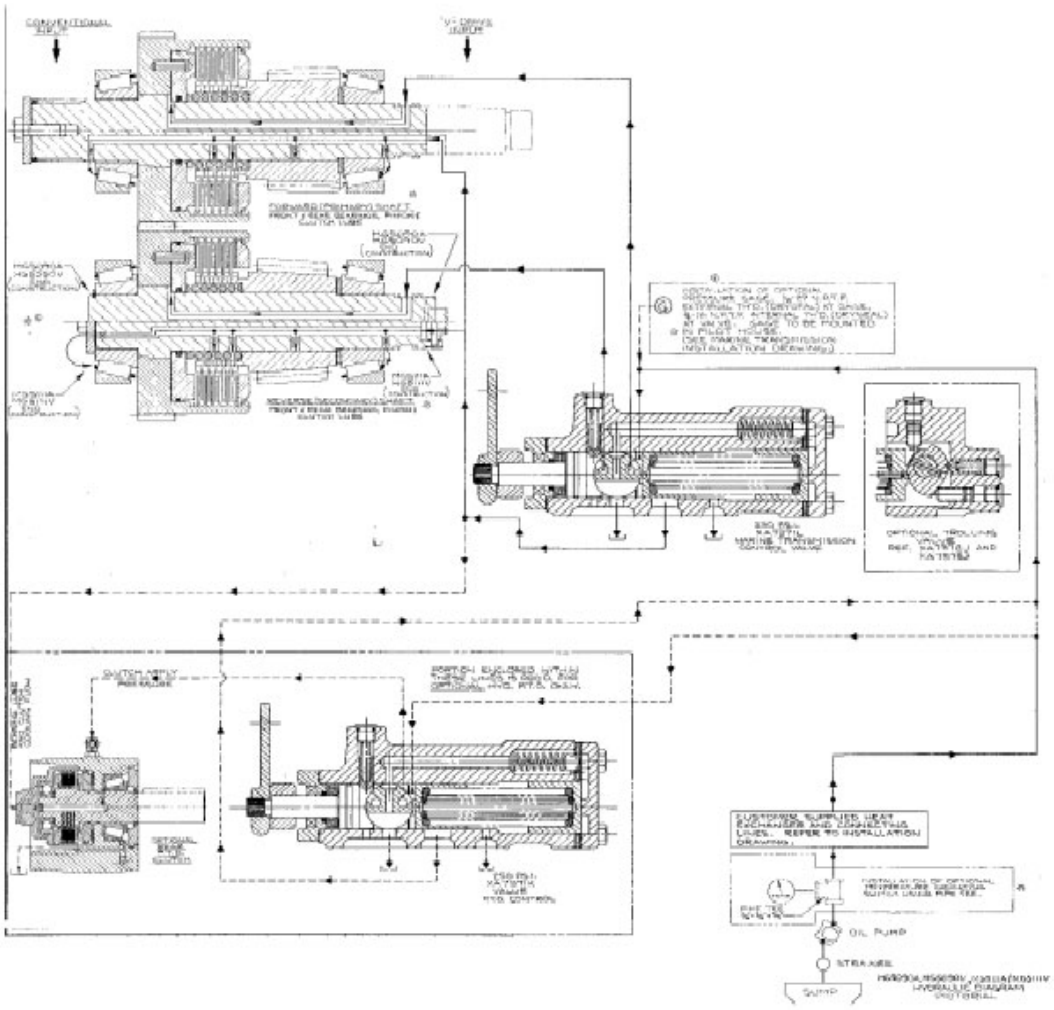


Figure 2. A7119V Hydraulic Schematic 1

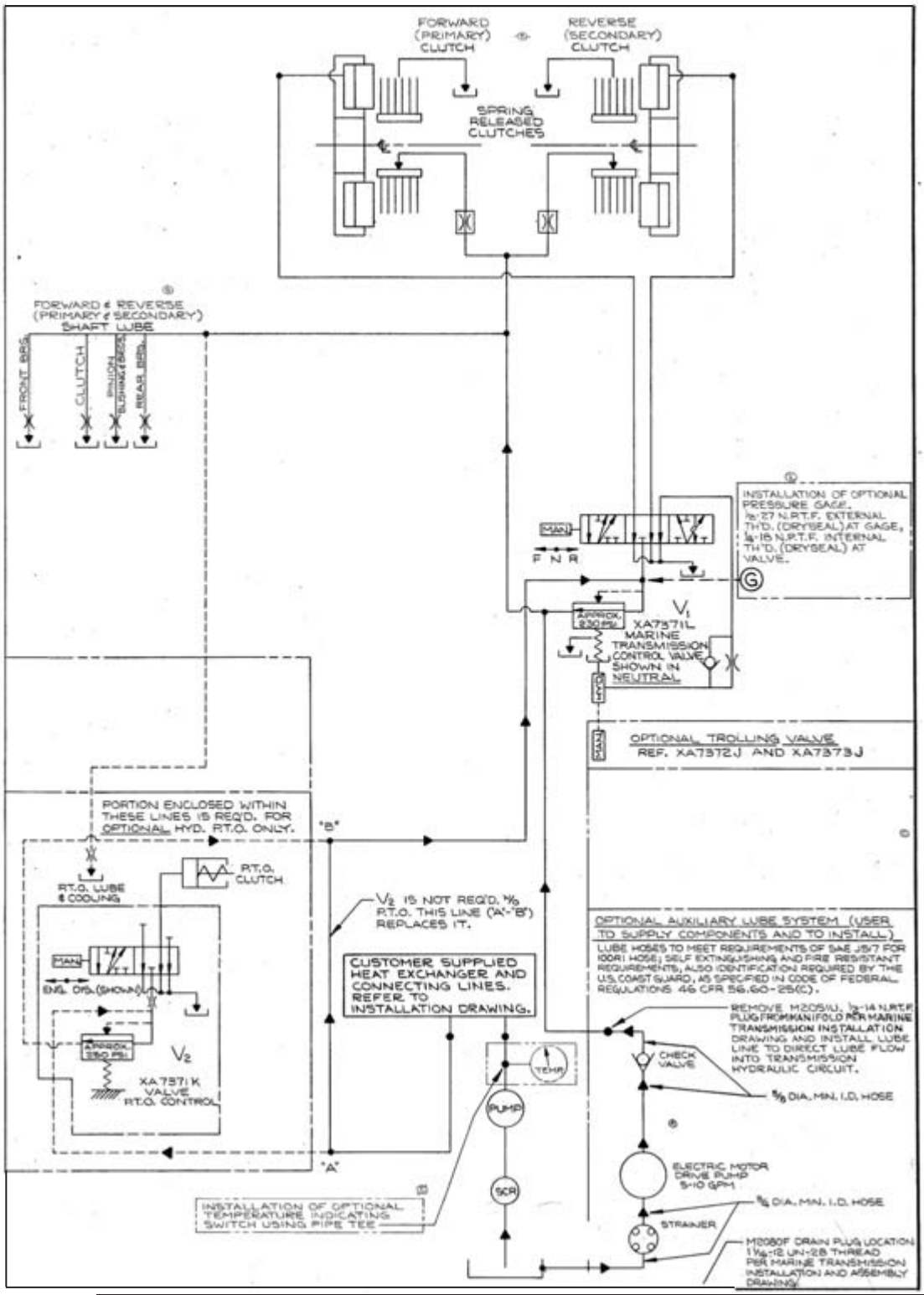

FORWARD (PRIMARY) CLUTCH
REVERSE (SECONDARY) CLUTCH
SPRING RELEASED CLUTCHES
FORWARD & REVERSE (PRIMARY & SECONDARY) SHAFT LUBE
FRONT BRG.
CLUTCH
PINION BEARING BRGS.
REAR BRG.
MAN
P N R
INSTALLATION OF OPTIONAL PRESSURE GAGE. 1/8-27 N.P.T.F. EXTERNAL THD. (DRYSEAL) AT GAGE, 1/8-18 N.P.T.F. INTERNAL THD. (DRYSEAL) AT VALVE.
APPROX. 230 PSI
V1
XA7371L MARINE TRANSMISSION CONTROL VALVE SHOWN IN NEUTRAL
HYD.
OPTIONAL TROLLING VALVE REF. XA7372J AND XA7373J
PORTION ENCLOSED WITHIN THESE LINES IS REQ'D. FOR OPTIONAL HYD. P.T.O. ONLY.
"B"
P.T.O. CLUTCH
P.T.O. LUBE & COOLING
V2 IS NOT REQ'D. IF P.T.O. THIS LINE ("A"-"B") REPLACES IT.
MAN
ENG. DIS. (SHOWN)
APPROX. 230 PSI
V2
XA7371K VALVE P.T.O. CONTROL
CUSTOMER SUPPLIED HEAT EXCHANGER AND CONNECTING LINES. REFER TO INSTALLATION DRAWING.
OPTIONAL AUXILIARY LUBE SYSTEM (USER TO SUPPLY COMPONENTS AND TO INSTALL)
LUBE HOSES TO MEET REQUIREMENTS OF SAE J517 FOR 100R1 HOSE; SELF EXTINGUISHING AND FIRE RESISTANT REQUIREMENTS, ALSO IDENTIFICATION REQUIRED BY THE U.S. COAST GUARD, AS SPECIFIED IN CODE OF FEDERAL REGULATIONS 46 CFR 56.60-25(c).
REMOVE M2051U, 1/2-14 N.P.T.F. PLUG FROM MANIFOLD PER MARINE TRANSMISSION INSTALLATION DRAWING AND INSTALL LUBE LINE TO DIRECT LUBE FLOW INTO TRANSMISSION HYDRAULIC CIRCUIT.
CHECK VALVE
5/8 DIA. MIN. I.D. HOSE
TEMP.
PUMP
SCR
ELECTRIC MOTOR DRIVE PUMP 5-10 GPM
5/8 DIA. MIN. I.D. HOSE
STRAINER
M2080F DRAIN PLUG LOCATION 1 1/16-12 UN-2B THREAD PER MARINE TRANSMISSION INSTALLATION AND ASSEMBLY DRAWING.
"A"
INSTALLATION OF OPTIONAL TEMPERATURE INDICATING SWITCH USING PIPE TEE

Figure 3. Hydraulic Schematic 2

Manual Control Valve — Neutral

Refer to Figures 4 and 5. Oil enters the control valve body through passage A and fills chamber B. Oil is also supplied to the rate of rise chamber which is pressure regulated by the neutral regulator springs and check ball. The oil causes the pressure regulating piston to partially compress the piston outer and inner springs against the pressure-rate control piston. This pressurizes the oil in chamber B and the rate of rise chamber. This pressure is controlled by the neutral regulator spring and shims.

The movement of the pressure regulation piston against the springs exposes port C in the valve body. Port C directs overage oil to the lubrication oil circuit. Passage D (which is the engaging outlet to the primary clutch) and Passage E (which is the engaging outlet to the secondary clutch) are interconnected by slot F in the control valve stem when in the neutral position. The slot is aligned with a drilled hole and cored cavity in the face of the valve body. The drilled hole and cored cavity are aligned and drilled holes that pass through the main housing to sump. Therefore, passages D and E are at atmospheric pressure at this time. Also, passage J is at atmospheric pressure because port H interconnects with slot F. This area between pistons and around springs is vented to the sump of the transmission. This area is at atmospheric pressure at all times permitting the return to sump of any leakage oil past the pistons.

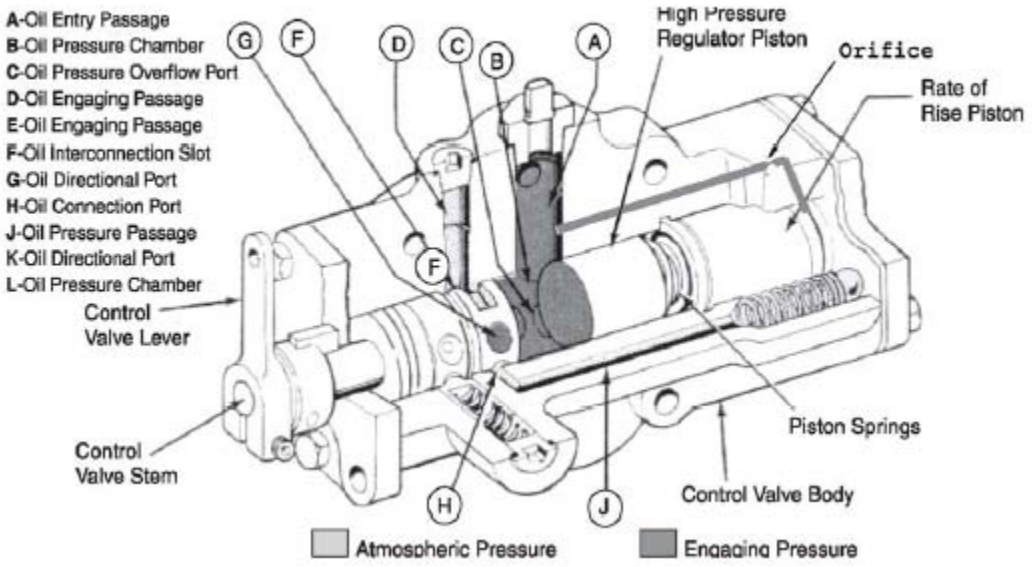


Figure 4. Mechanical Control Valve - Neutral - Cutaway View

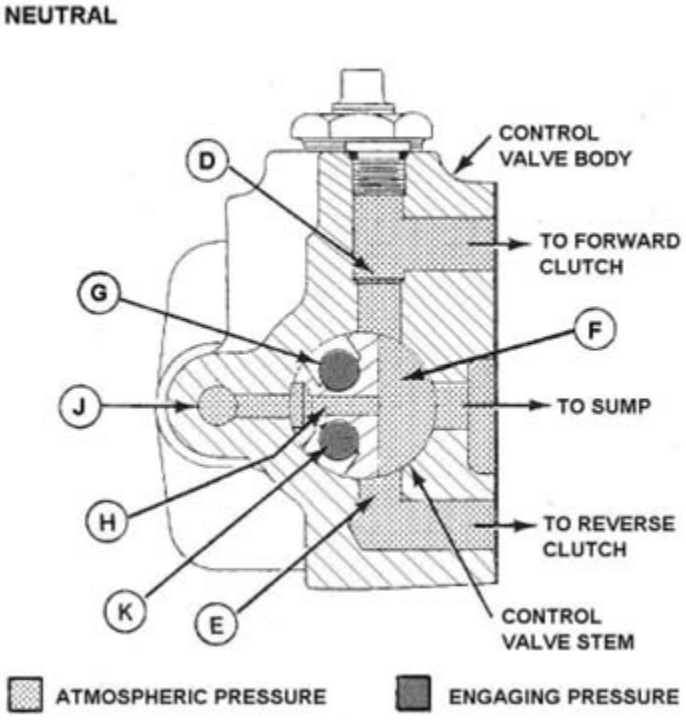


Figure 5. Mechanical Control Valve - Neutral - Sectional View

Manual Control Valve — Primary

When a shift to the primary position is desired, the control valve lever is moved. The shift causes the control valve stem to rotate and assume the position indicated in Figures 6 and 7. The pressurized oil in chamber B is directed through ports G and K to passages D and J. Passage D is aligned with a passage directing main pressure oil to the primary clutch. Pressurized oil from port K travels through passage J and seats the ball against its seat, thus preventing oil from exiting chamber L to sump. Oil also travels from chamber A through an orifice into chamber L. This orifice meters the oil for a steady, smooth pressure rise from the neutral regulated pressure in chamber L. As chamber L fills with oil, the pressure rate-control piston moves against the springs until the piston is stopped by a shoulder in the valve body. This causes the pressure in chamber B to rise to clutch engaging pressure. When in primary, passage E remains at atmospheric pressure because slot F remains open to sump.

When a shift is made from primary to neutral, the valve stem is rotated to the position illustrated by Figures 4 and 5. Under these conditions, passage D is connected to sump by slot F. Passage J also is connected to sump by port H in the valve stem. Because passage D is connected to slot F, oil drains rapidly from the primary clutch to sump. Because passage J is now at atmospheric pressure, the oil pressure in chamber L unseats the steel ball against the compression spring permitting a rapid oil drain from chamber L to sump and allowing the pressure-rate control piston to move back until the cavity is once again at the neutral regulated pressure. The primary clutch is now disengaged and main system pressure reduced to neutral pressure.

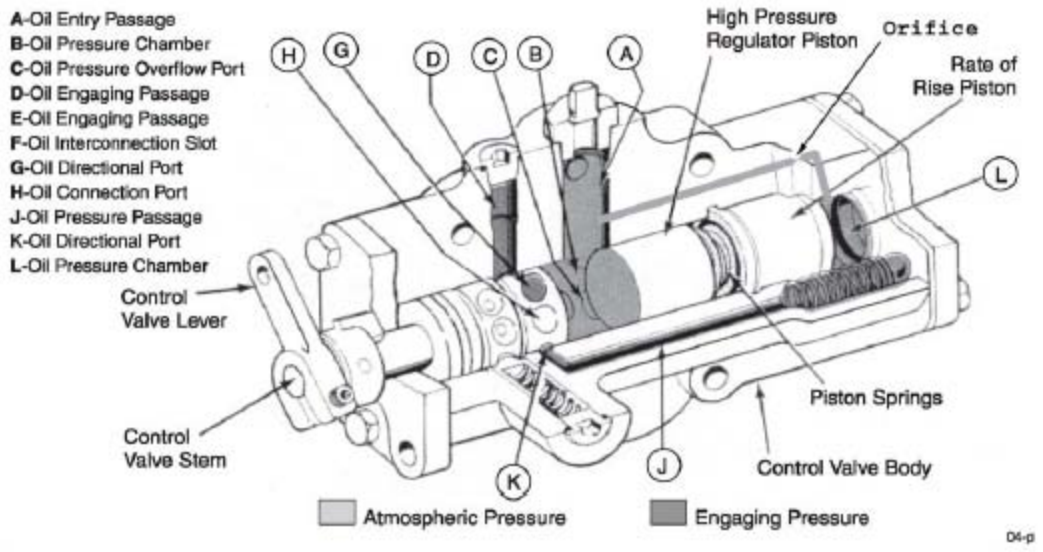


Figure 6. Mechanical Control Valve - Primary - Cutaway View

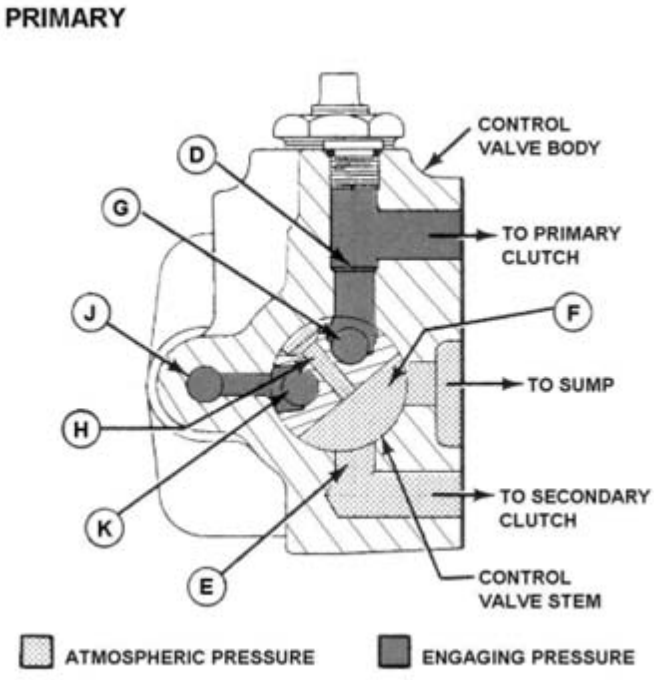


Figure 7. Mechanical Control Valve - Primary - Sectional View

Manual Control Valve — Secondary

When a shift to the secondary position is desired, the control valve lever is moved. The shift causes the control valve stem to rotate and assume the position indicated in Figures 8 and 9. The pressurized oil in chamber B is directed through ports G and K to passages E and J. Passage E is aligned with a passage directing main pressure to the secondary clutch. Pressurized oil from port G travels through passage J and seats the ball against its seat, thus preventing oil from exiting chamber L to sump. Oil also travels from chamber A through an orifice into chamber L. This orifice meters the oil for a steady, smooth pressure rise from the neutral regulated pressure in chamber L. As chamber L fills with oil, the pressure rate-control piston moves against the springs until the piston is stopped by a shoulder in the valve body. This causes the pressure in chamber B to rise to clutch engaging pressure. When in primary, passage D remains at atmospheric pressure because slot F remains open to sump.

When a shift is made from secondary to neutral, the valve stem is rotated to the position illustrated by Figures 4 and 5. Under these conditions, passage E is connected to the sump by slot F. Passage J is also connected to sump by port H in the valve stem. Because passage E is connected to slot F, oil drains rapidly from the secondary clutch to sump. Because passage J is now at atmospheric pressure, the oil pressure in chamber L unseats the steel ball against the compression spring, permitting a rapid oil drain from chamber L to sump and allowing the pressure rate control piston to move back until the cavity is once again at the neutral regulated pressure. The secondary clutch is now disengaged and main system pressure reduced to neutral pressure.

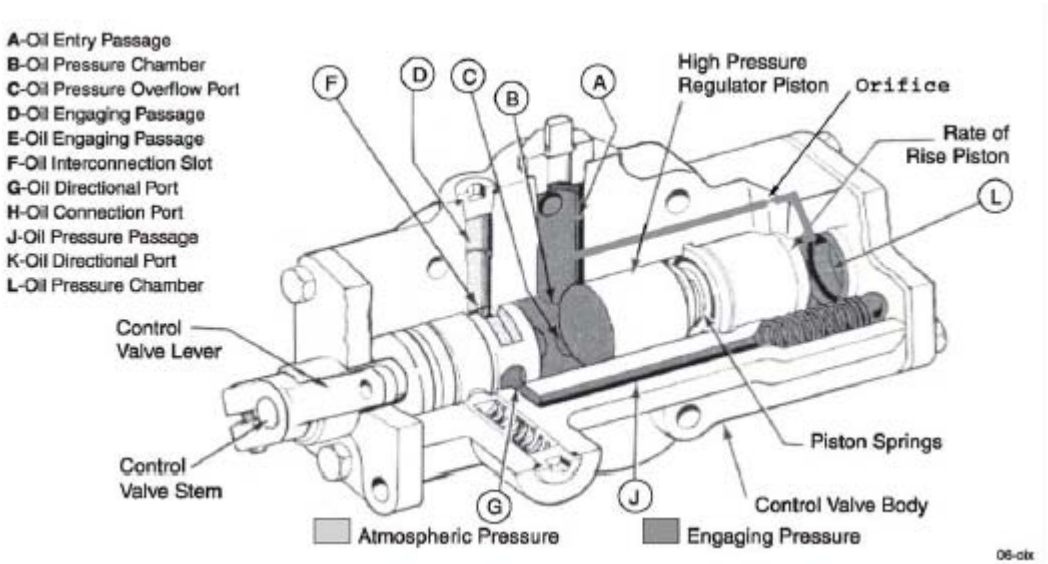


Figure 8. Mechanical Control Valve - Secondary - Cutaway View

Secondary

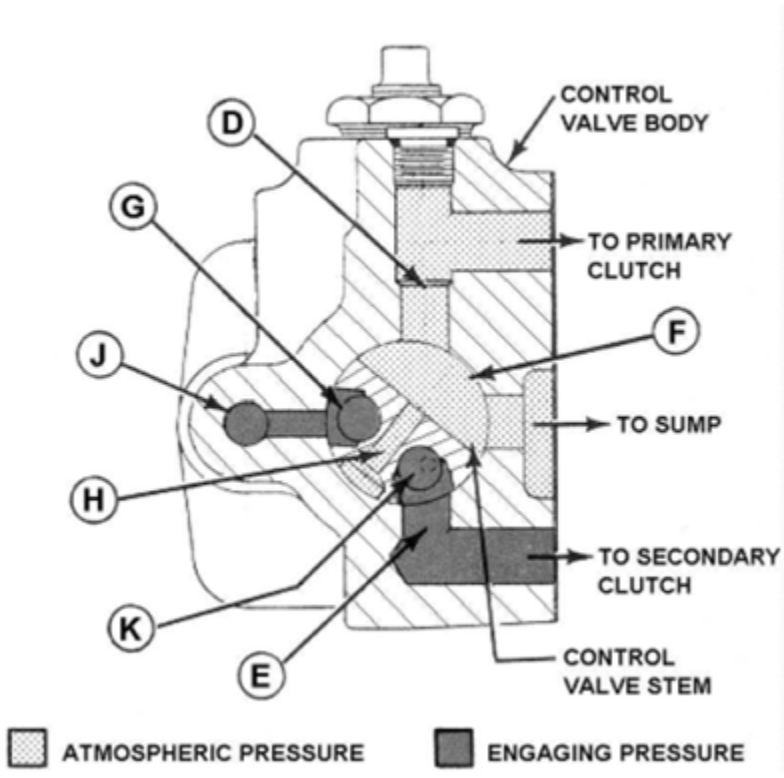


Figure 9. Mechanical Control Valve - Secondary - Sectional View

GP Control Valve with Electronic Interface

The General Purpose (GP) control valve is a hydraulic valve assembly for use with Twin Disc Marine Transmissions that may include an integral electronic interface control module. The valve assembly contains current controlled proportional cartridges.

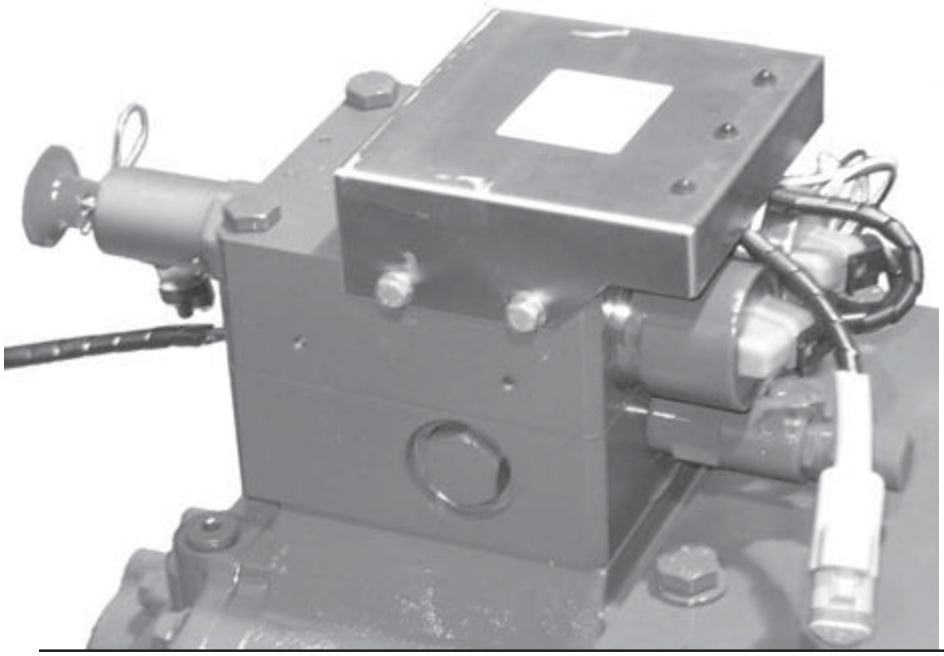


Figure 10. GP Valve Assembly mounted on Marine Transmission.

GP Control Valve Hydraulic Portion

The hydraulic portion of the GP Control Valve is made up of two blocks, a lower main regulator valve body and an upper valve body. The upper valve body contains two electrically actuated proportional valves and a manual direction control cartridge valve. The lower valve body contains the hydraulic pressure regulating valve and a temperature sensor, if the application requires it. There are two versions of the lower valve assembly. The hydraulic pressure regulating valve in earlier versions (Assembly 1020729) consists of two cartridge assemblies, a pilot relief cartridge assembly and a main spool cartridge assembly. The hydraulic pressure regulating valve in later versions (Assembly 1021658) is not a cartridge assembly but is comprised of a spring and spool with an adjustment cover. The regulating valve body contains a ball check valve assembly in parallel with an orifice with a filter that provides rapid fill and damping for the rear cavity of the regulator valve. A kit is available to upgrade the earlier version to the later version. A temperature sensor is housed in the main regulator valve body on some applications. The manual direction control cartridge valve contains a switch that is closed when the valve is in the neutral position. Separate identical proportional cartridges are used for primary and secondary clutch actuation. When the primary or secondary clutch is selected by the operator, the control valve directs high-pressure oil through internal passages to operate the clutches. The pressure rate-of-rise (profile) is controlled electronically by the GP Control Valve Electronic Interface (Profile or E-Troll Module) to provide a rapid, smooth oil pressure increase in the clutch hydraulic passages during engagement.

⚠ CAUTION

The proportional valve coils are low resistance devices that are current driven. The use of an uncontrolled power source may supply too much current and damage the proportional valve.

Note: Installations with this valve must include an oil filter with the proper filtering characteristics. This valve requires a filtration level of 16 micron at an efficiency of 98% (beta ratio = 75) or better. The filter must meet the valve requirements on filtrationand the requirements of the transmission (operating pressure, flow, etc.)

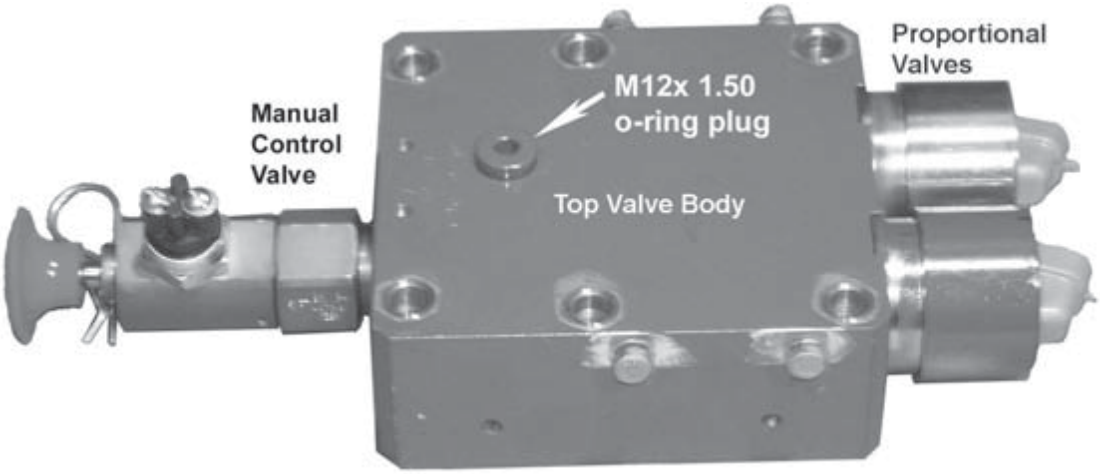


Figure 11. Top Hydraulic Valve Body Assembly

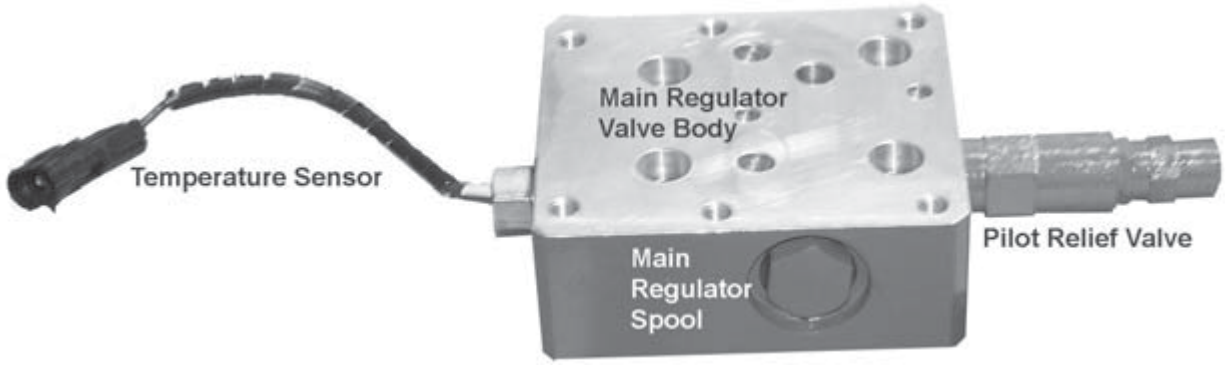


Figure 12. Main Regulator Hydraulic Valve Assembly (1020729)

Figure 13. Main Regulator Assembly (1021658)

GP Control Valve Electronic Control Interface (Profile or E-Troll Module)

Note: Some installations will consist of the hydraulic portion of this valve and the Electronic Control Interface will be replaced by an appropriate electronic control system.

The electronic portion of the GP Control Valve fastens to the hydraulic portion of the GP Control Valve, and is located on the top surface. This module contains electronic circuitry to control the proportional cartridges that are used to engage the clutches based on the commands from the operator. Clutch apply pressure rate-of-rise (profile) is factory set with the use of internal circuitry. The initial fill level is factory set with an adjustment screw that is embedded in the bottom surface of the Profile or E-Troll Module and sealed. This can be field adjusted, if necessary, by authorized personnel with the proper instrumentation. There are two types of control modules for the MG-5145A marine transmission, with and without the trolling (E-Troll) feature. All electrical wiring for the marine transmission system controls are routed through this interface module. The vessel battery power (12 VDC or 24 VDC) is supplied to the electronic interface only and never directly to the hydraulic proportional valves. Two red LED lights are used to identify the proportional cartridge valve that is energized and a green LED is used to identify when power is provided to energize one of the clutches. Signals are provided to power a customer supplied relay to allow engine starting only when in Neutral. A transmission oil temperature sensor is required for the MG-5145A marine transmission. Engine speed and propeller speed sensors are required for transmissions with E-Troll. The following figures show the various versions of Electronic Profile or E-Troll Module.

⚠ WARNING

Do not connect valve coils directly to battery power supply voltage. Use an approved Twin Disc Control System.

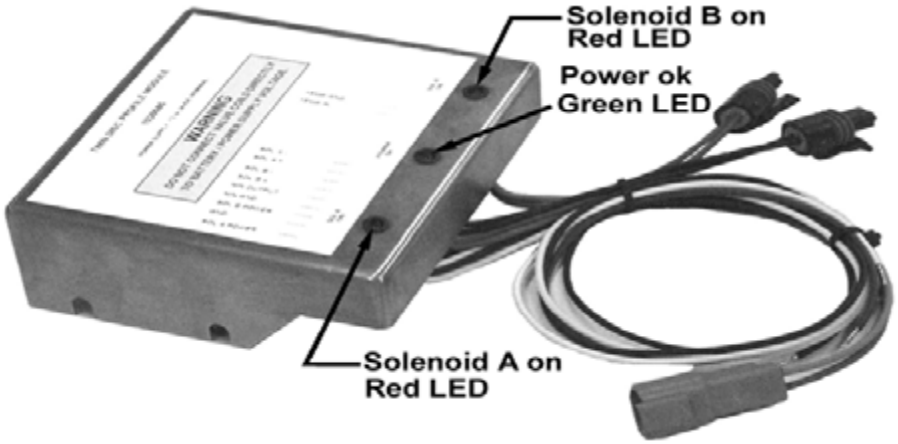


Figure 14. Electronic Profile Non-Troll Module

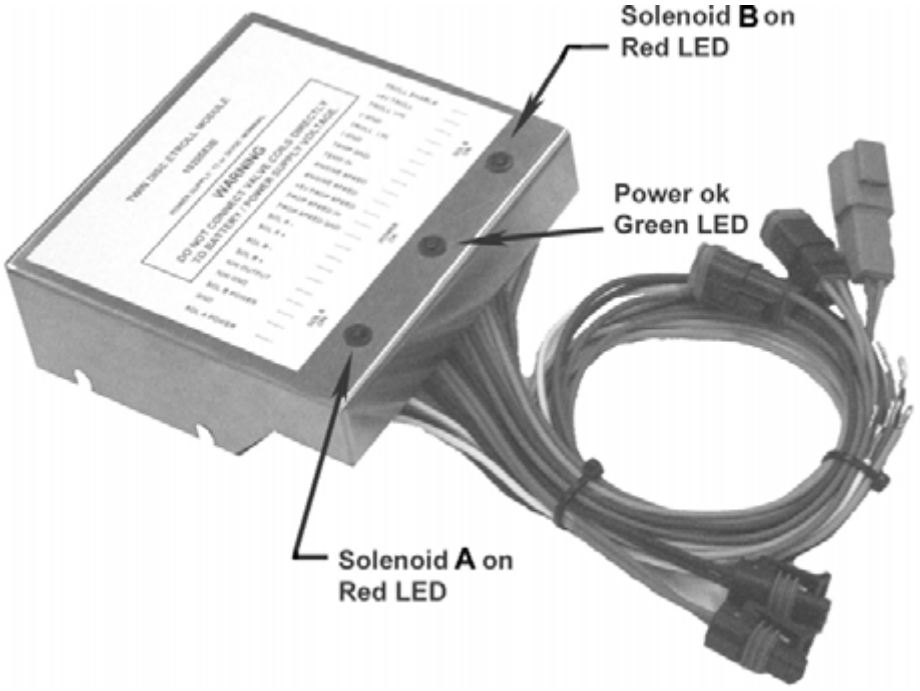


Figure 15. Electronic E-Troll Module

Hydraulic System with GP Control Valve

The oil pump draws oil through the strainer from the oil sump and discharges it through the heat exchanger to the oil filter. Filtered oil enters the control valve through the inlet port. The incoming oil (Assembly 1020729) is supplied to the main pressure regulating relief pilot cartridge and the main regulating valve cartridge, satisfying the main pressure requirements of the transmission, cascading all remaining oil flow into the lubrication circuit. The incoming oil (Assembly 1021658) is supplied to the main pressure regulating valve and is supplied in parallel paths through a ball check valve and an orifice with filter to quickly regulate and dampen pressure oscillations, satisfying the main pressure requirements of the transmission, cascading all remaining oil flow into the lubrication circuit. Oil not used for clutch engagement flows past the regulator piston to become lubrication oil. Lubrication oil flows through the lubrication oil circuit in the transmission to lubricate and cool the clutches and bearings.

Main pressure is supplied to the inlet of each proportional valve and to the inlet of the manual direction control valve. In Neutral, the inlet port of both clutches is connected to the sump. Since the area behind the clutch pistons is open to sump, the clutches are disengaged.

When one of the clutches is commanded to engage, the proportional valve directs main pressure to engage the selected clutch pack. The rate-of-rise is controlled electronically and prefills the engaging clutch at a predetermined level and then increases to full pressure, following a predetermined timing sequence. The initial prefill level is factory adjustable by means of an adjustment screw embedded in the bottom surface of the electronic interface. Field adjustment of this feature should never be attempted without special equipment and knowledge of its use to prevent serious mechanical damage to the marine transmission or vessel.

The electronic interface portion of the control valve allows only one proportional valve to be energized at a time, thus, only one clutch can be engaged at a time and the oil from the disengaged clutch is vented to sump (atmospheric pressure). The clutch return springs move the disengaged clutch's piston to the disengaged position minimizing clutch plate drag.

Note: Installations with this valve must include an oil filter with the proper filtering characteristics. This valve requires a filtration level of 16 micron at an efficiency of 98% (beta ratio = 75) or better. Besides the valve's requirement on filtration, the filter must meet the requirements of the transmission (operating pressure, flow, etc.)

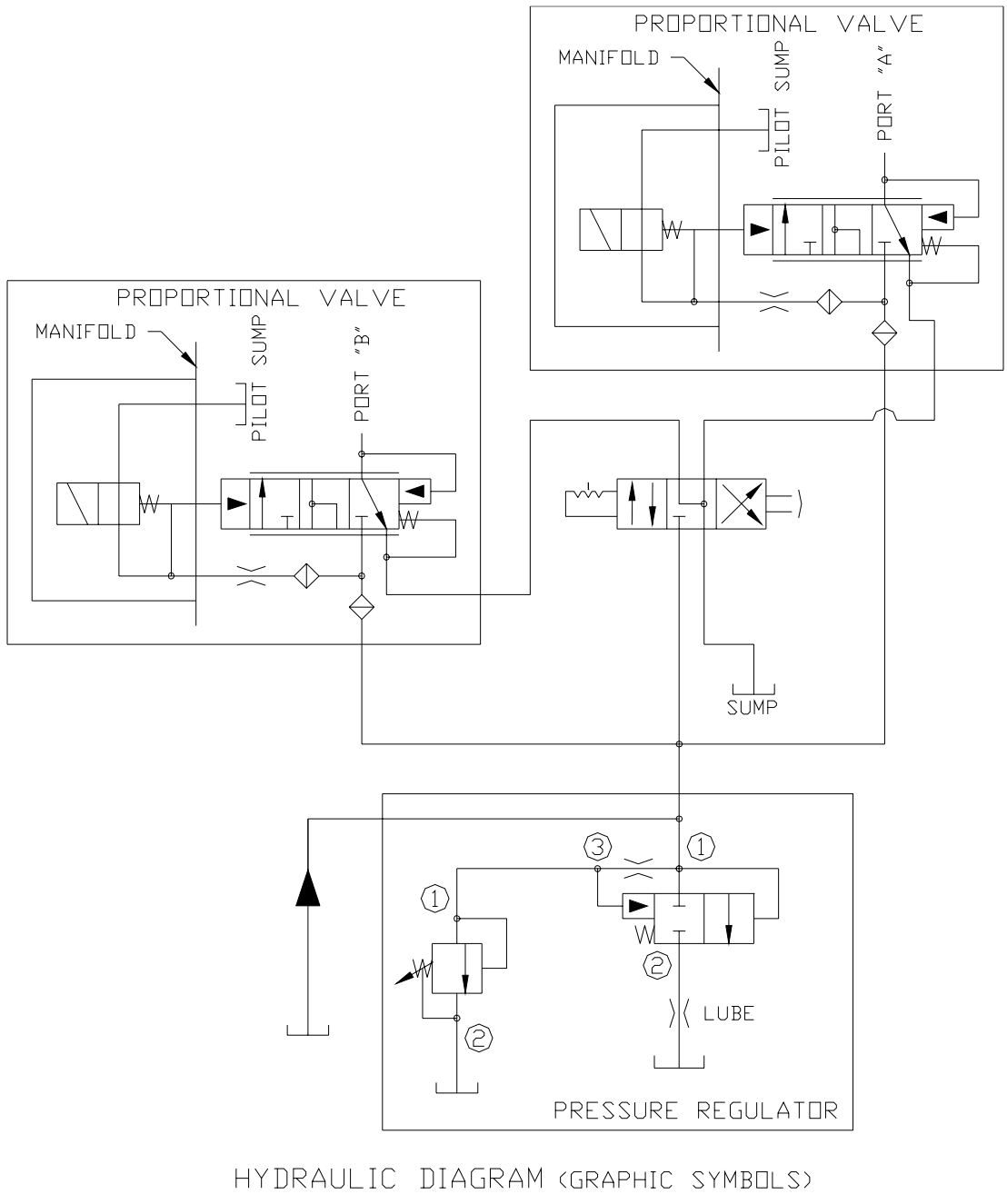


Figure 16. Hydraulic Schematic (GP control valve)- Assembly 1020729

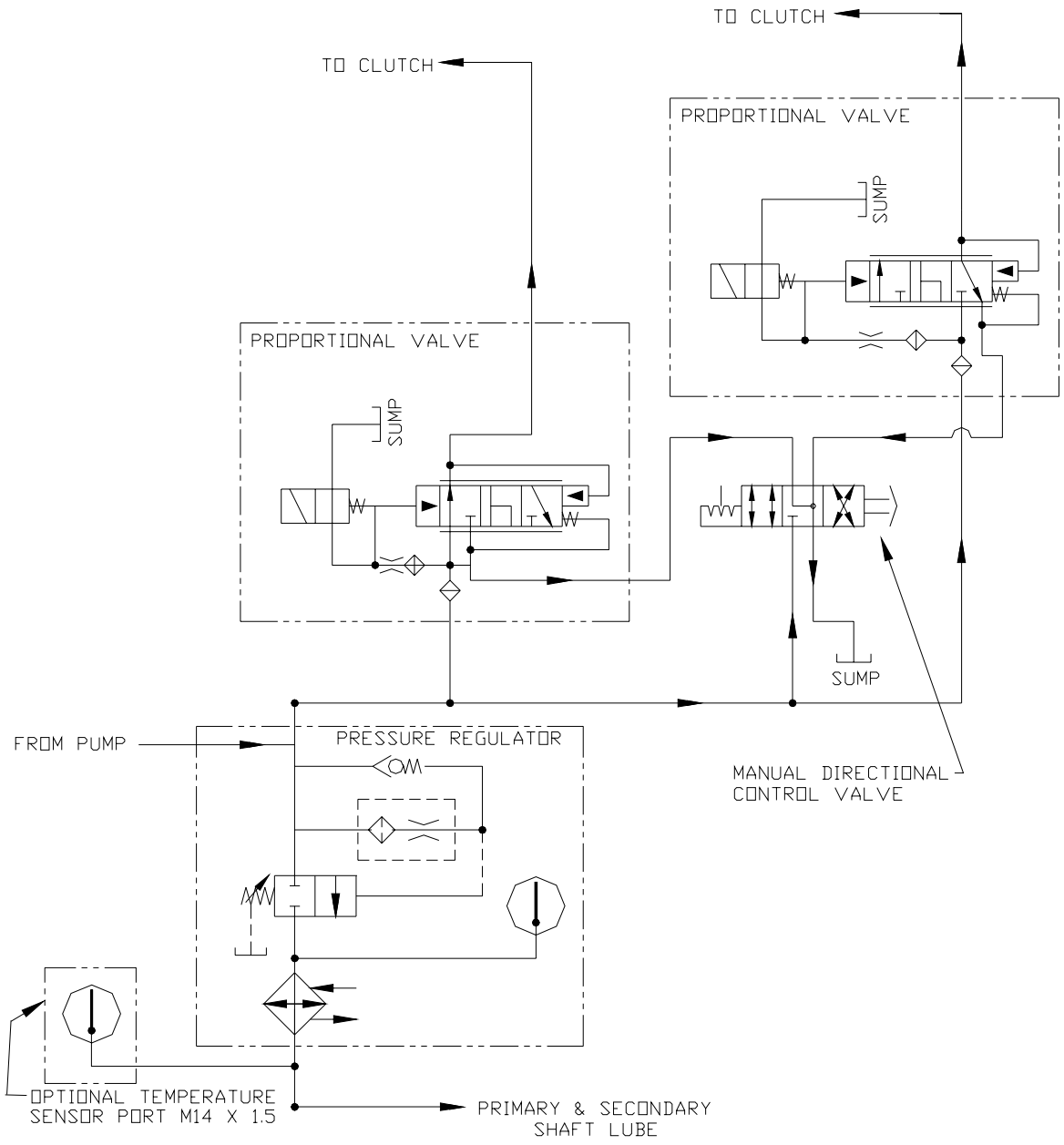


Figure 17. Hydraulic Schematic (GP control valve) -- Assy 1021658

Manual Direction Control Valve Operation

The manual direction control valve is locked in the Neutral (center) position during normal operation. There are three possible positions of the manual direction control valve stem. If a condition occurs where the proportional valve is not operational for any reason, the operator can remove the locking pin from the direction control valve and push the stem into the valve for engagement of clutch A or pull it out of the valve for engagement of clutch B. The manual direction control valve has an integral switch with contacts that are closed only when the manual direction control valve is in the neutral position.

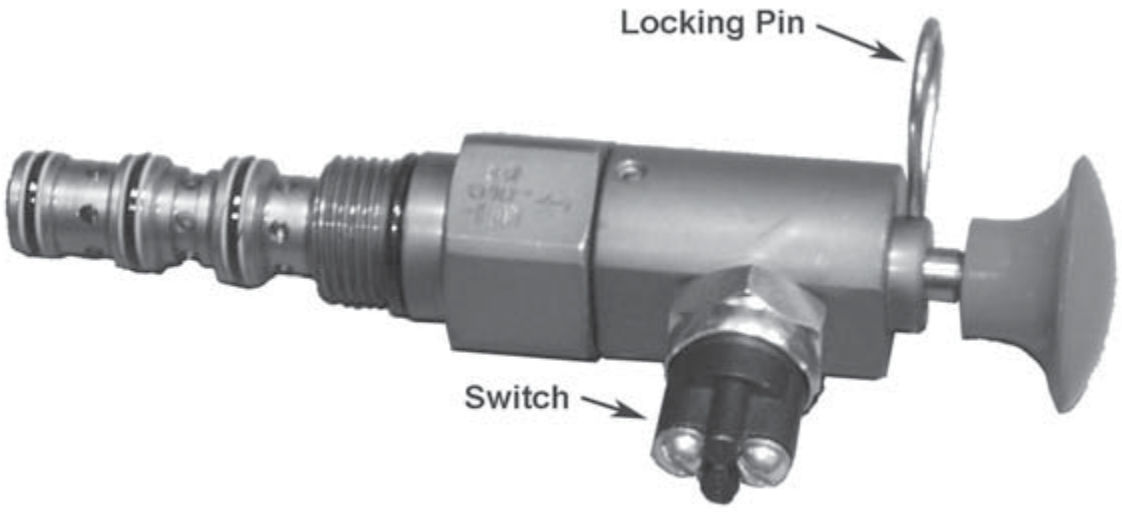


Figure 18. Manual Direction Control Valve

Trolling Valve (Optional)

The trolling valve is used to reduce and control propeller speed below that normally attained by operating the engine at low idle. Actuating the trolling function reduces clutch apply pressure to reduce the propeller speed.

⚠ CAUTION

Install the pilot house instruction plate B2464, in an area near the trolling valve control head in the pilot house, where it may be easily read. Failure to obey this operating limit can result in major damage to marine transmission components, which can cause an unsafe operation condition to occur. Unsafe operating conditions could result in loss of vessel maneuvering control, vessel damage, and/or loss of property and/or life.

Note: Be sure to observe and record marine transmission sump oil temperature. If temperature drops below 135° F during mode operation, it is recommended that a thermostatic by-pass valve be installed in the transmission's hydraulic circuit. Consult Twin Disc for appropriate recommendation. The operator must select the trolling mode with the control valve lever in neutral and set the engine speed at or below the recommended maximum trolling rpm (See Description and Specifications).

⚠ CAUTION

Do not operate marine transmission in the trolling mode at engine speeds above the maximum trolling rpm. The maximum engine speed in trolling is 1100 rpm or 40% of match point engine speed, whichever is smallest.

Mechanical Trolling Valve (PX-8871)

This trolling valve is a variable orifice that controls the pressure in the rate-of-rise chamber. The pressure in the rate-of-rise chamber determines the rate-of-rise piston position, which ultimately controls the main and clutch pressures for the transmission.

When the trolling valve lever is in the detent (non-trolling) position, the orifice in the trolling valve is closed. Oil cannot exit from the rate-of-rise chamber through the trolling valve's orifice, and the rate-of-rise chamber is fully pressurized (the ball and spring regulator is blocked when either clutch is engaged). This full pressure causes the rate-of-rise piston to remain against its stop in the valve body bore, and main oil pressure is not reduced.

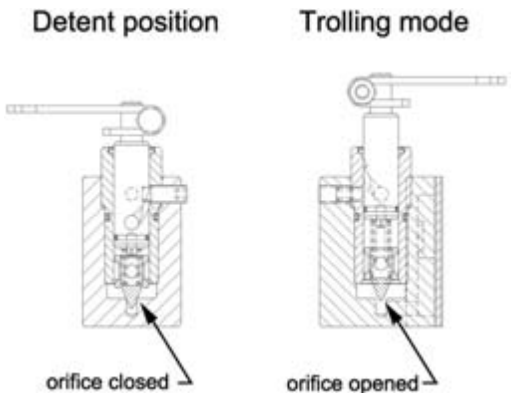


Figure 19. Mechanical Trolling Valve (PX-8871)

Rotating the trolling valve lever into the trolling mode opens the variable orifice, allowing some of the oil to escape from the rate-of-rise chamber to sump. This reduces the oil pressure in the rate-of-rise chamber. Since oil is always flowing into the rate-of-rise chamber through the orifice in the orifice plate, the pressure in the rate-of-rise chamber is controlled by how much oil is allowed to exit through the trolling valve's variable orifice. The trolling valve lever position determines the pressure in the rate-of-rise chamber, which determines main oil pressure. Main oil pressure is always the same as the oil pressure in the engaged clutch with this type of trolling valve.

Electric Trolling Valve (1020230)

This trolling valve is a variable orifice that controls the pressure in the rate-of-rise chamber. The pressure in the rate-of-rise chamber determines the rate-of-rise piston position, which ultimately controls the main and clutch pressures for the transmission. The only difference between the electric trolling valve and the previously described mechanical trolling valve is that the electric trolling valve's orifice size is controlled by electrical current instead of a lever.

When the trolling valve is in the cruise (non-trolling) mode, the orifice in the trolling valve is closed. Oil cannot exit from the rate-of-rise chamber through the trolling valve's orifice, and the rate-of-rise chamber is fully pressurized (the ball and spring regulator is blocked when either clutch is engaged). This full pressure causes the rate-of-rise piston to remain against its stop in the valve body bore, and main oil pressure is not reduced.

The trolling valve is actuated by sending a controlled amount of current through the valve's coil. As the current is increased, the orifice progressively opens, allowing oil pressure from the rate-of-rise chamber to escape to sump. Since oil is always flowing into the rate-of-rise chamber through the orifice in the orifice plate, the pressure in the rate-of-rise chamber is controlled by how much oil is allowed to exit through the trolling valve's variable orifice. Since the oil pressure in the rate-of-rise chamber is reduced, clutch pressure is reduced which allows the clutch plates to slip. The amount of clutch slip is controlled by the current flow (amps) through the valve's coil. Decreasing the current through the valve's coil will increase clutch pressure and therefore reduce clutch slip. Main oil pressure is always the same as the oil pressure in the engaged clutch with this type of trolling valve. The 1020230 valve contains no user serviceable parts, and is available only as an assembly.

Power Take-off (Optional)

There is a separate manual (part number 1020075) which describes the operation, installation, troubleshooting, and service of the optional Power Takeoffs (PTO) for this marine transmission.

Live Power Take-off (PX-9768)

The live PTO drives accessories using engine horsepower. Since the live PTO connects the accessory to the primary shaft of the transmission via a direct coupling, the accessory is driven whenever the engine is running.

Hydraulic Clutched Power Take-off (PX-11615 Series)

The PX-11615 model has a keyed PTO output shaft. The PX-11615A model has internal splines and accepts an SAE J744 size “C” pump.

The hydraulic clutched PTO also allows accessories to be driven using engine horsepower. Since the PTO is attached to the primary shaft of the transmission, the accessories can be driven any time the engine is running. The PTO is engaged by the PTO control valve, which is very similar to the valve used to control the transmission clutches.

The hydraulic clutched PTO operates with an engaged clutch pressure greater than that of the transmission’s primary and secondary clutches. For this reason, the PTO control valve (pressure increasing valve) is in the transmission’s hydraulic circuit before the control valve’s inlet and pressure regulator. Pressurized oil from the filter is directed to the PTO control valve, with the overage oil flowing to the transmission’s control valve.

Power Flow

Input power to the transmission is through a torsional coupling mounted on the engine flywheel. The coupling is splined to the forward end of the primary (forward clutch) shaft causing the primary shaft to rotate in engine direction during engine operation. Power is transmitted to the secondary shaft by means of the transfer gear teeth on the outer diameter of the primary clutch housing. These teeth are in constant mesh with gear teeth on the of the secondary clutch housing causing the secondary shaft to rotate in anti-engine direction. The primary and secondary pinions on their respective shafts are in constant mesh with the output gear, which is connected to the output shaft through a keyless tapered joint.

Application of the primary clutch locks the primary pinion to the primary shaft causing the pinion to turn in the shaft direction and causing the output shaft to rotate in anti-engine direction. Application of the secondary clutch locks the secondary pinion to the secondary shaft causing the pinion to turn in the shaft direction and causing the output shaft to rotate in engine direction.

Note: The following power flow illustrations are shown merely as examples of power flow and may not pertain specifically to your unit.

Neutral

When in neutral the primary and secondary shafts, transfer gears and clutch friction plates rotate at engine speed.

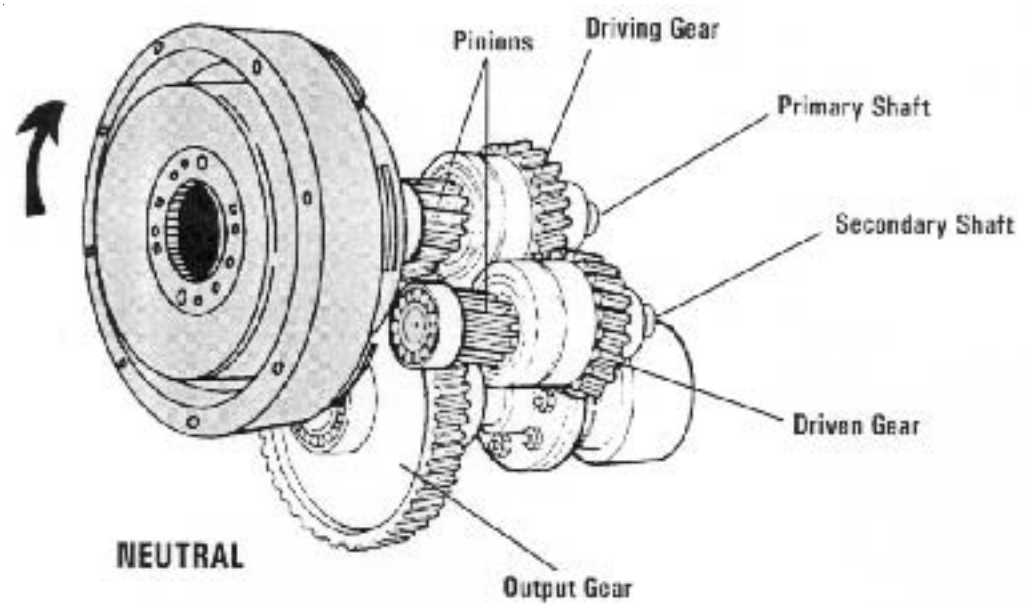


Figure 20. Example of Power Flow in Neutral

Primary

When the primary position is selected, hydraulic pressure is applied to the primary clutch piston clamping the friction and steel clutch plates together. The primary input pinion will then rotate at engine speed and direction because the steel plates are spline-connected through the clutch hub assembly to the pinion. Because the primary input pinion is in mesh with the output gear, the output gear and shaft will rotate in anti-engine direction. The secondary input pinion will be backdriven (engine direction) when the unit is in the primary position.

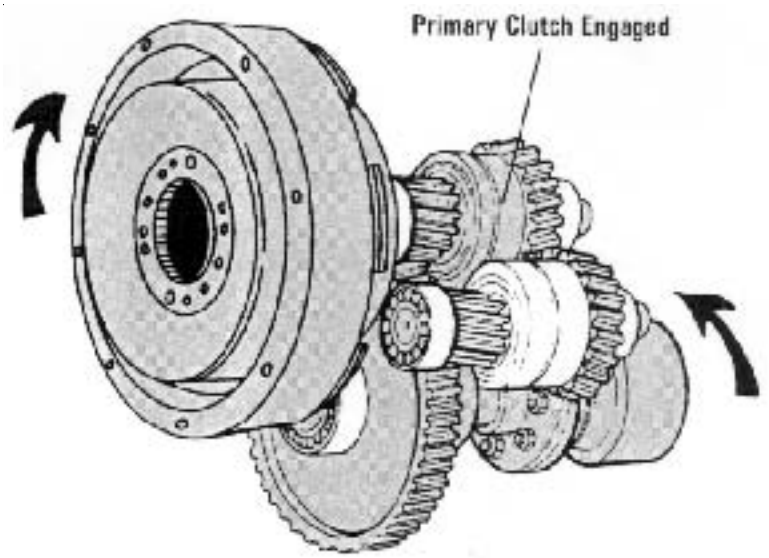


Figure 21. Example of Power Flow with Primary Clutch Engaged

Secondary

In secondary, the same parts are turning that were turning in neutral. When the secondary position is selected, hydraulic pressure is applied to the secondary clutch piston clamping the friction and steel plates together. The secondary input pinion will then rotate at engine speed and anti-engine direction, because the steel clutch plates are spline connected through the clutch hub assembly to the input pinion. Because the secondary input pinion is in mesh with the output gear, the output gear and shaft will rotate in engine direction. The primary input pinion will be backdriven (anti-engine direction) when the unit is in the secondary position.

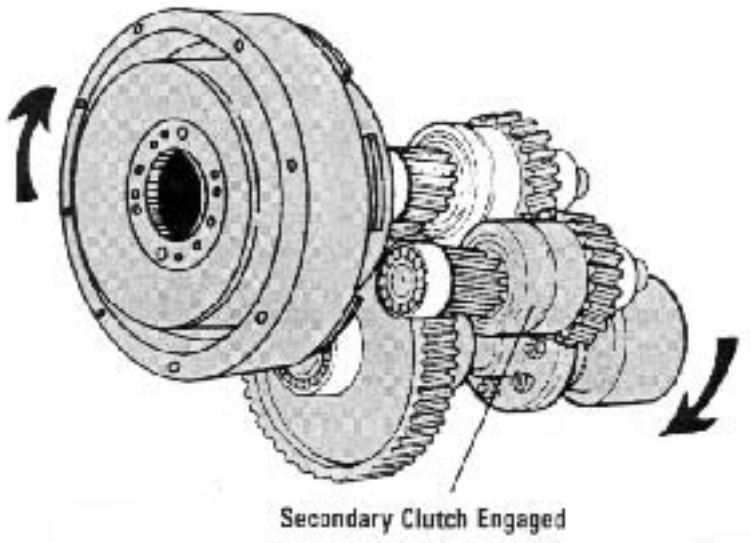


Figure 22. Example of Power Flow with Secondary Clutch Engaged

NOTES

Preventative Maintenance

In-boat Maintenance and Repair

Certain transmission maintenance/repair procedures can be accomplished in the boat provided sufficient space exists to work. These procedures are:

- ❑ Removing and installing the oil pump.
- ❑ Changing the filter.
- ❑ Removing, cleaning and installing the suction strainer.
- ❑ Removing and installing the control valve.
- ❑ Removing and installing the manifold.

Note: Further disassembly/reassembly of the primary or secondary shafts will require removal from the engine, and the use of tools and equipment normally not available on board the vessel.

General Maintenance

Overhaul Interval

A complete overhaul and thorough inspection of the unit should be made at the same time as the scheduled engine overhaul. Refer to Cleaning and Inspection for more detailed inspection instructions.

Oil System

Oil Level

The oil level should be checked daily or every 10 hours. Check oil level before starting the engine to confirm that the transmission has oil in it. With the engine running at low idle and the transmission in Neutral, check the oil again. The oil level should be near the “low” oil level mark. Transmission oil temperature should be in the normal operating range prior to finalizing the oil level between the low and full marks on the oil level gauge.

Oil and Filter Change Interval (Maximum)

Note: A suction screen is located in the suction line to the pump, and the oil filter (if equipped) is located in the pump outlet line. Both should be checked and cleaned at the stated intervals.

With a new transmission, change the oil and filter element(if equipped),and clean the suction strainer (screen) within the first 50 hours of operation. Change oil and filter element and clean the screen after each 1000 hours thereafter or more often if conditions warrant.

For a rebuilt transmission, check the filter element (and/or screen) after eight hours of operation. If the filter and/or screen is clean, install a new filter element (if equipped) and then change the oil and filter element after 1000 hours of service. If the filter is dirty, change the element and operate for another eight hours. Check the filter again. Continue this cycle until the filter is clean and then change the oil and filter after 1000 hours of service or more often if conditions warrant.

Draining

Drain the transmission by removing the O-ring plug at the rear side at the bottom. Use a 38 mm wrench to loosen the drain plug.

Oil Suction Strainer

Remove and clean the pump suction strainer at every oil change or sooner if necessary. The suction strainer is located in the manifold below the pump. See Engineering Drawings for suction strainer location. (See discussion under oil change interval.)

Type Oil Recommended

See Description and Specifications.

Filling

1. Remove the filler breather in the top of the transmission.
2. Fill the transmission's sump with the proper weight and type oil. See Description and Specifications for oil recommendations.
3. Start the engine and let it idle with transmission in neutral until oil is circulated throughout the hydraulic system. Add oil if necessary to bring the oil level up to the "low" mark with the engine at low idle.
4. With the oil at operating temperature, transmission in neutral, and the engine running at low idle, check the oil level with the oil gauge. Add or remove oil if necessary to bring the oil level to "FULL" mark on the oil gauge. Allow the oil temperature to cool to normal cold oil conditions (perhaps overnight). Check the oil level while cold at low idle engine speed while in neutral. This is the proper oil level with cold oil. Make note of the oil level in the cold conditions for future reference. **DO NOT** overfill the tranmission. The oil level should not be over the full mark at operating temperature.

⚠ IMPORTANT

Liquid sealant must cure for a minimum of 24 hours prior to contact with oil.

Periodic Visual Inspection

General

- ❑ Check the mountings for tightness or damage such as cracks. Tighten loose mountings and replace damaged parts.
- ❑ Check pressure and temperature gauge where applicable.
- ❑ Periodically, inspect the drive line and the input and output shaft oil seals for leakage. Replace parts as required.
- ❑ Inspect unit nameplates for looseness and corrosion. Tighten mounting screws that are loose and replace nameplates that are corroded.
- ❑ Inspect and oil the exposed stem of the Manual Direction Control Valve for corrosion protection.

Torsional Coupling

DO NOT obstruct the flywheel housing vents preventing the free flow of air for cooling the coupling. The ambient temperature of the air around the coupling should be between -6° C (22° F) and 80° C (176° F). Assure baffles are installed properly so hot air is ported out of the housing.

Visually inspect the element after the first 100 hours of operation and every 2000 hours thereafter, or every six months, whichever comes first. Torsional vibration, misalignment, degradation by contaminants (oil), heat, ultraviolet radiation, and excessive system torque can cause cracks or other signs of distress to appear on the surface of the rubber. The above-described items affect the life of the coupling element. Perform a complete inspection whenever the transmission is removed from the engine for any reason.

When inspecting the flexible coupling, look for evidence or conditions identified in the following steps:

- ❑ Cracks in the surface of the rubber. May be caused by torsional vibrations, excessive misalignment or exposure to contaminants (heat, petroleum products, chemicals, ozone, ultraviolet radiation, etc.) excessive system torques.
- ❑ Separation of rubber from flex plate on coupling plate or deterioration of the rubber-to-metal bond. See above.

- ❑ Deterioration of the rubber element, as evidenced by sponginess or by black carbon-like dust on rubber surface may be caused by contaminants or excessive heat, either external or internal to the coupling.
- ❑ Cracked, bent or otherwise damaged flex plate or coupling plate.
- ❑ Bolt holes in flex plate or coupling plate elongated or deformed. This could be caused by improperly assembled parts, loose parts, vibration or improperly torqued parts.
- ❑ Bolts/nuts—bent, worn or stripped threads.

Inspect the hub, looking for the following:

- ❑ Damaged or worn splines.
- ❑ Cracked parts.
- ❑ Oil seal surface for wear or damage.

Replace any defective parts including defective fasteners that are found.

Heat Exchanger Check

Inspect heat exchanger oil lines for leaky connections, kinks, cracks or other damage. Replace damaged lines. Heat exchangers furnished by Twin Disc to be used for salt water applications have zinc rods installed at the inlet and outlet heads. These rods must be checked every 90 days. If over 50% of the rod is disintegrated, it should be replaced to provide effective protection. Excessive corrosion of the zinc rod indicates electrolytic action. A careful inspection should be made to determine if this action is caused by a short circuit or external grounded electric current. If these conditions do not exist, it is evident that the corrosion is due to local electrolysis. If rods are corroded with foreign materials, they should be cleaned with a wire brush.

NOTES

Troubleshooting

Troubleshooting of Mechanical and Electric Control Valves

General

Note: Some of the troubleshooting procedures vary, depending on the type of control valve that is installed on the transmission. A thorough understanding of the valve operation is important to properly troubleshooting the problem that is occurring.

The following charts are intended as a guide for determining the cause of problems that could be encountered and the corrective actions for those difficulties.

The transmission is one part of a complete power package. Problems in the input power system or the output power delivery components can cause problems to develop in the transmission. It is therefore important that the entire power package be considered when problems are encountered.

Pressure Test Kit

The Digital Pressure Transducer Kit (BOM 42168) provides two pressure transducers (0 to 500 psi) with hydraulic quick couplings, a power supply box for the transducers, and cables needed to connect the transducers to the power supply box and the signals out of the power supply box to a customer supplied digital volt meter. Contact the Twin Disc Service Department, Racine Wisconsin for specific information concerning this test kit.

One principle of troubleshooting is to start with the simple and move to the more difficult. Check the simple items first. Run the simple test first. Then move to the more difficult.

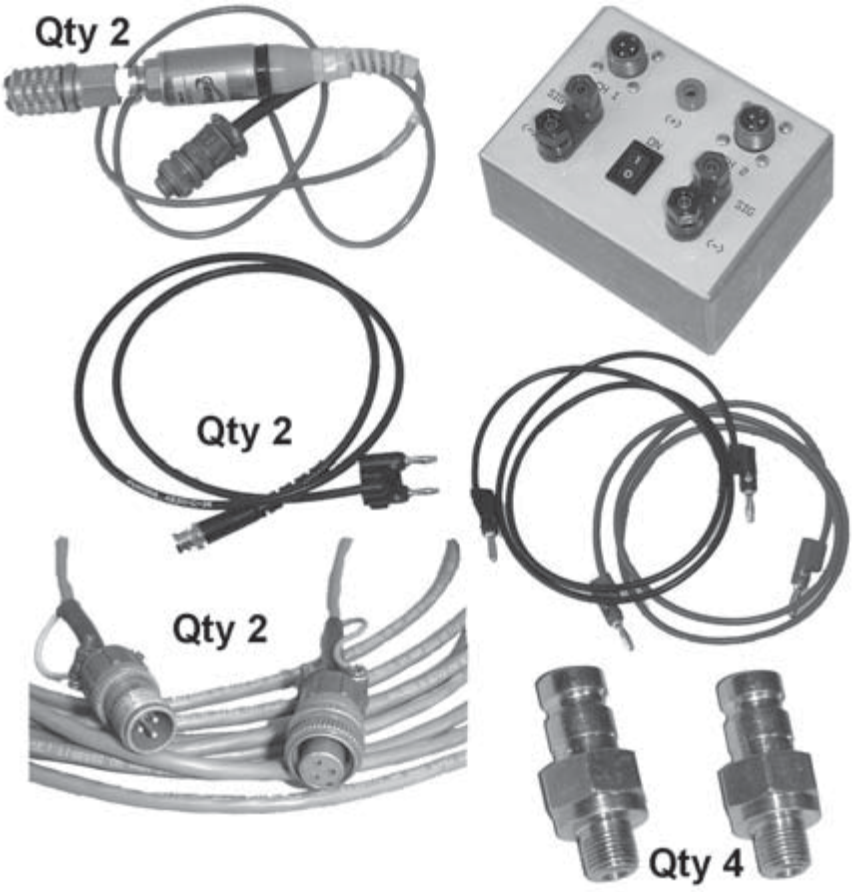


Figure 23. Test kit 42168

Table 17. Troubleshooting Chart - Mechanical and Electric Control Valves

Symptom	Cause	Remedy
1. Low main oil pressure.	1-1. Partially clogged oil strainer.	1-1. Remove and clean oil strainer.
	1-2. Stuck pressure regulation piston.	1-2. Disassemble the valve and clean the piston.
	1-3. Broken piston rings on clutch shaft(s).	1-3. Remove the collector and inspect piston rings.
	1-4. Damaged or worn oil pump assembly.	1-4. Replace damaged or worn oil pump assembly.
	1-5. Incorrect linkage adjustment to control valve assembly.	1-5. Adjust linkage so that valve stem is indexed properly by detent.
	1-6. Clogged or plugged orifice in orifice plate of control valve assembly.	1-6. Remove orifice plate cover. Clean parts.
	1-7. Shimming required between regulator springs and rate-of-rise piston.	1-7. Shim as required.
	1-8. Engine idle speed too low.	1-8. Raise engine speed.
2. No oil pressure, or erratic low pressure at control valve tap.	2-1 Oil pump strainer plugged.	2-1. Remove and clean strainer.
	2-2. Oil level low.	2-2. Check oil level and correct.
	2-3. Air leak on suction side of pump.	2-3. Correct cause of air leak.
	2-4. Pump drive on reverse clutch shaft broken.	2-4. Disassemble and repair as required.
	2-5. Regulating valve stuck in open position.	2-5. Remove, disassemble, clean and repair the regulating valve.
	2-6. Oil pump defective.	2.6. Replace oil pump.
	2.7. Leaking heat exchanger has caused oil to be lost over board.	2.7. Replace heat exchanger.
3. High main oil pressure	3-1. Regulating valve stuck.	3-1. Remove and clean regulating valve.
	3-2. Improperly shimmed.	3-2. Shim as required.
	3-3. Lube relief valve malfunction.	3-3. Inspect, repair or replace parts as necessary.

Table 17. Troubleshooting Chart - Mechanical and Electric Control Valves (continued)

Symptom	Cause	Remedy
4. High temperature.	4-1. Improper oil level.	4-1. Check and fill (or drain) with proper oil to the correct level.
	4-2. Faulty heat exchanger.	4-2. Inspect, repair or replace heat exchanger.
	4-3. Clutches slipping.	4-3. Check clutch apply oil pressure. If pressure is normal, remove, disassemble, and repair slipping clutch.
	4-4. Bearing failure.	4-4. Overhaul marine transmission.
	4-5. Air leak on suction side of pump.	4-5. Inspect and correct cause of suction leak.
	4-6. Control valve malfunction.	4.6. Inspect, repair, or replace control valve.
5. Excessive noise.	5-1. Bearing failure.	5-1. Overhaul marine transmission.
	5-2. Worn or damaged input coupling.	5-2. Remove marine transmission. Replace a worn or damaged coupling.
	5-3. Excessive torsional vibration.	5-3. Select proper torsional coupling.
	5-4. Worn or damaged gears.	5-4. Overhaul marine transmission.
	5-5. Improper alignment.	5-5. Check alignment of engine transmission output flange to propeller shaft. Correct as necessary.
	5-6. Damaged propeller.	5-6. Repair propeller.
	5-7. Misfiring engine.	5-7. Repair engine.
6. No neutral.	6-1. Clutch plates warped.	6-1. Remove clutch plates. Overhaul unit.
	6-2. Control valve incorrectly indexed.	6-2. Check and adjust control linkage.
	6-3. Solenoid malfunction (units equipped with electric selector valve).	6-3. Replace defective solenoid.
	6-4. Hydraulic lock piston stuck (units equipped withelectric selector valve).	6-4. Inspect, repair or replace hydraulic lock spool.

Table 17. Troubleshooting Chart - Mechanical and Electric Control Valves (continued)

Symptom	Cause	Remedy
7. Harsh engagement.	7-1. Regulating piston or rate-of-rise piston stuck.	7-1. Disassemble control valve. Clean parts. Replace parts if necessary.
	7-2. Orifice plate ball in control valve not seating properly.	7-2. Remove orifice plate cover. Clean parts. Replace parts if necessary.
	7-3. Blown gasket on either side of orifice plate.	7-3. Replace gasket.
8. Oil spilling out of breather.	8-1. Pump flow output too low.	8-1. Replace pump.
	8-2. Pump suction strainer plugged.	8-2. Remove, clean, inspect, and install the suction screen.
	8--3. Air leak on suction side of pump.	8-3. Inspect and correct cause of suction leaks.
	8-4. Lube relief valve malfunction.	8-4. Remove and clean or replace parts as necessary.
	8-5. Broken piston rings.	8-5. Replace damaged piston rings.
9. Oil spilling out of breather.	9-1. Oil level too high.	9-1. Adjust oil level.
	9-2. Wrong type of oil.	9-2. Draw and refill with recommended oil.

Troubleshooting of GP Control Valve with Electronic Interface

General

The transmission is one part of a complete power package. Problems in the input power system or the output power delivery components can cause problems to develop in the transmission. It is therefore important that the entire power package be considered when problems are encountered.

Electronic Interface LED Indicators

The electronic interface control modules have one green and two red led indicator lights. The green power light is illuminated ony when the transmission is in gear.

The following table lists the reasons for the various conditions where lights are illuminated. This should guide in troubleshooting problems. See the wiring schematics in the Installation Section.

Troubleshooting Tables begin on the next page.

Table 18. LED Light Status

Light Status	Profile Generator	E-troll Module (Non trolling)
Green light on	Supply voltage > 9.0 volts.	Supply voltage > 9.0 volts.
Red light on	Valve coil command on.	Valve coil command on.
One red light flashing	Open circuit in an energized valve coil circuit. MG-5145A only: Valve coil leads shorted together or low coil current.	Open circuit in an energized valve coil circuit or valve coil leads shorted together or low coil current.
Both red lights flashing simultaneously	MG-5145A only:Power is applied tosolenoid A and B switch inputs at the same time. MGX-5145A only: Not applicable.	After entering troll from neutral with both voltage and current troll speed signals present, or power is applied to solenoid A and B switch inputs at the same time.
Both red lights flashing alternately	Not applicable	Either or both speed signals missing.

Table 19. Troubleshooting Chart - GP Manual Control Valve with Electronic Interface

Symptom	Cause	Remedy
1. Low main oil pressure.	1-1. Partially clogged oil strainer.	1-1. Remove and clean oil strainer.
	1-2. Contamination on Pilot Relief Valve seat.	1-2. Disassemble the Pilot Relief Valve and clean. Service the transmission oil filter.
	1-3. Contamination in Main valve Cartridge.	1-3. Clean or replace Main Valve cartridge and service the transmission oil filter.
	1-4. Broken piston rings on clutch shaft(s).	1-4. Remove the collector and inspect the piston rings.
	1-5. Damaged or worn oil pump assembly.	1-5. Replace damaged or worn oil pump assembly (pump is not serviceable).
	1-6. Engine idle speed too low.	1-6. Raise engine speed.
2. No oil pressure, or erratic low pressure at control valve tap.	2-1 Oil pump suction strainer plugged.	2-1. Remove and clean strainer.
	2-2. Oil level low.	2-2. Check oil level and correct.
	2-3. Air leak on suction side of pump.	2-3. Correct cause of air leak.
	2-4. Pump drive on reverse clutch shaft broken.	2-4. Disassemble and repair as required.
	2-5. Pilot Relief Valve or Main Regulating Valve stuck in open position.	2-5. Remove, disassemble, clean and repair the Pilot Relief Valve. Remove, clean or replace the Main Regulating Valve. This valve cannot be disassembled.
	2-6. Oil pump defective.	2.6. Replace oil pump.
	2.7. Leaking heat exchanger has caused oil to be lost over board.	2.7. Replace heat exchanger.
3. High main oil pressure	3-1. Pilot Relief Valve is out of. adjustment.	3-1. Adjust Pilot Relief Valve. Replace if necessary.
	3-2. Main Regulating Valve orifice missing.	3-2. Replace Main Regulating Valve cartridge.

Table 19. Troubleshooting Chart - GP Manual Control Valve (continued)

Symptom	Cause	Remedy
4. High temperature.	4-1. Improper oil level.	4-1. Check and fill (or drain) with proper oil to the correct level.
	4-2. Faulty heat exchanger.	4-2. Inspect, repair or replace heat exchanger.
	4-3. Clutches slipping.	4-3. Check clutch apply oil pressure. If pressure is normal, remove, disassemble, and repair slipping clutch. If pressure is low, replace Proportional Valve and service the transmission oil filter.
	4-4. Bearing failure.	4-4. Overhaul marine transmission.
	4-5. Air leak on suction side of pump.	4-5. Inspect and correct cause of suction leak.
	4-6. Control valve malfunction.	4.6. Inspect, repair, or replace control valve.
5. Excessive noise.	5-1. Bearing failure.	5-1. Overhaul marine transmission.
	5-2. Worn or damaged input coupling.	5-2. Remove marine transmission. Replace a worn or damaged coupling.
	5-3. Excessive torsional vibration.	5-3. Select proper torsional coupling.
	5-4. Worn or damaged gears.	5-4. Overhaul marine transmission.
	5-5. Improper alignment.	5-5. Check alignment of engine transmission output flange to propeller shaft. Correct as necessary.
	5-6. Damaged propeller.	5-6. Repair propeller.
	5-7. Misfiring engine.	5-7. Repair engine.
6. No neutral.	6-1. Clutch plates warped.	6-1. Remove clutch plates. Overhaul unit.
	6-2. Disengaged clutch has apply pressure.	6-2. Replace Proportional Valve. Service Transmission oil filter.

Table 19. Troubleshooting Chart - GP Manual Control Valve (continued)

Symptom	Cause	Remedy
7. Harsh engagement.	7-1. Faulty Proportional Valve. 7-2. Faulty Temperature Sensor (if equipped). 7-3. Profile Generator defective or out of adjustment.	7-1. Replace Proportional Valve. 7-2. Replace Temperature Sensor. 7-3. Replace Profile Generator. Adjust if proper equipment is available.
8. Low lube pressure	8-1. Pump flow output too low. 8-2. Pump suction strainer plugged. 8--3. Air leak on suction side of pump. 8-4. Lube relief valve malfunction. 8-5. Broken piston rings.	8-1. Replace pump. 8-2. Remove, clean, inspect and install the suction screen. 8-3. Inspect and correct cause of suction leaks. 8-4. Remove and clean or replace parts as necessary. 8-5. Replace damaged piston rings.
9. Oil spilling out of breather.	9-1. Oil level too high. 9-2. Wrong type of oil.	9-1. Adjust oil level. 9-2. Draw and refill with recommended oil.
10. Low Clutch Apply Pressure	10-1. Low Main Pressure 10-2. Defecive Proportional Valve. 10-3. Low voltage to Profile Generator	10-1. See Paragraph 1. 10-2. Replace Proportional Valve. 10-3. Verify that green (voltage supply) light and red (clutch energized) lights are bright.

NOTES

Disassembly

The following procedure is for complete disassembly of the unit. Prior to this procedure, the transmission should be removed from the boat. Qualified personnel should do the work in a fully equipped facility.

Prepare Transmission for Disassembly

Note: During the service of this unit, all O-rings, gaskets and seals must be replaced. It is good practice to keep the used components (O-rings, gaskets, and seals) with the appropriate components for reference during the inspection and assembly process (to make sure you don't forget the quantity, size, etc.).

⚠ CAUTION

Flat washers are used under all fasteners where the head of the fastener contacts an aluminum surface.

Pipe threads called out as PT (British Standard Pipe Tapered) on drawings and in this text are different from NPT threads. PT threads and NPT threads are NOT interchangeable. Adapters are available from several manufacturers to convert PT threads to NPT threads.

Most pusher screws used in the disassembly of this transmission are threaded through aluminum parts. ALWAYS LUBRICATE the threads of the pusher screw before threading it into the mating part. When installing pusher screws, avoid rapid tightening with an impact wrench or similar device. If an impact wrench is used with the pusher screws the threads may gall or seize in the aluminum part. Tighten pusher screws in an even manner to avoid damaging components.

MG-5145A Component Identification

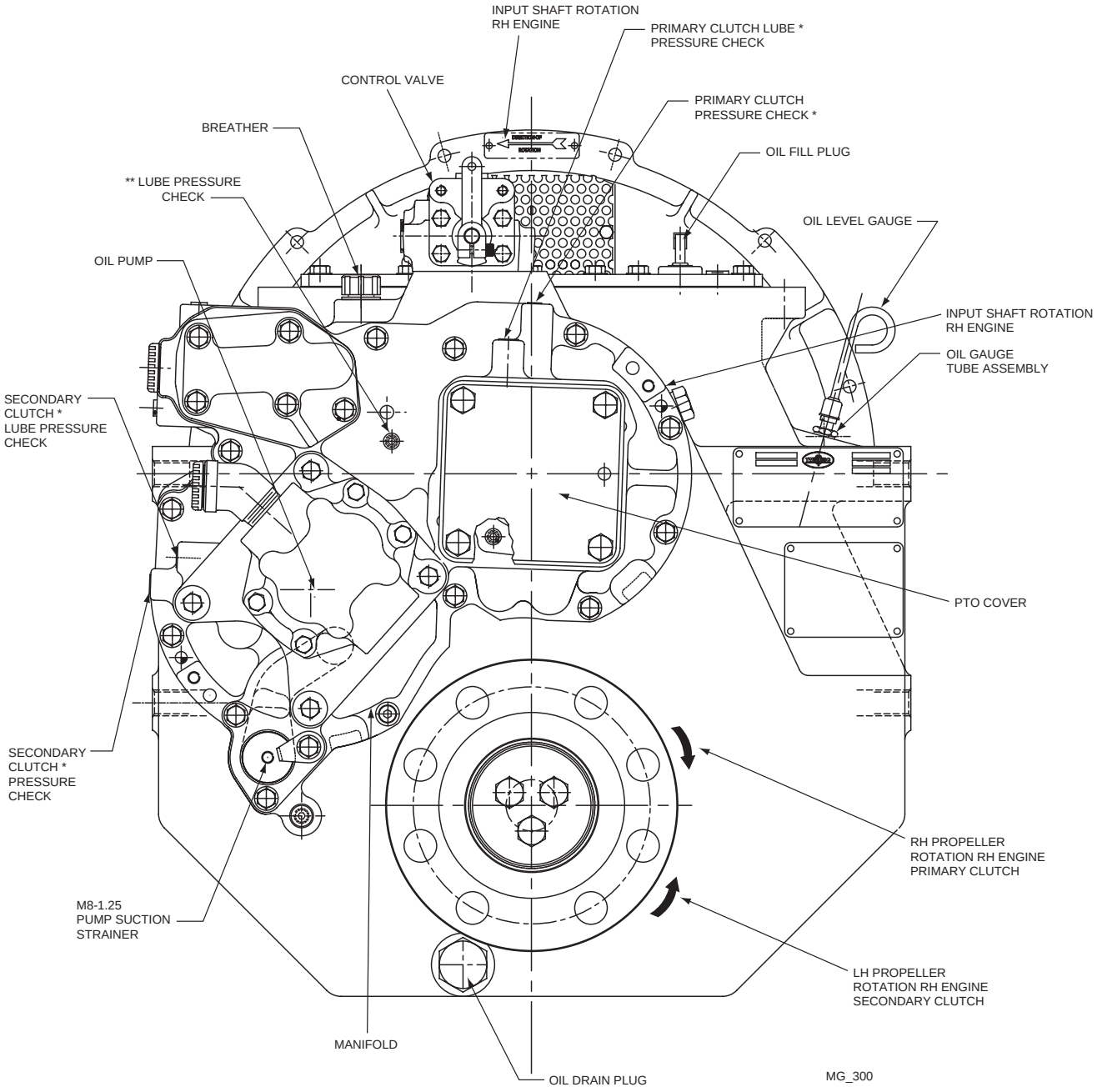


Figure 24. MG-5145A with Mechanical or Electrical Control Valve

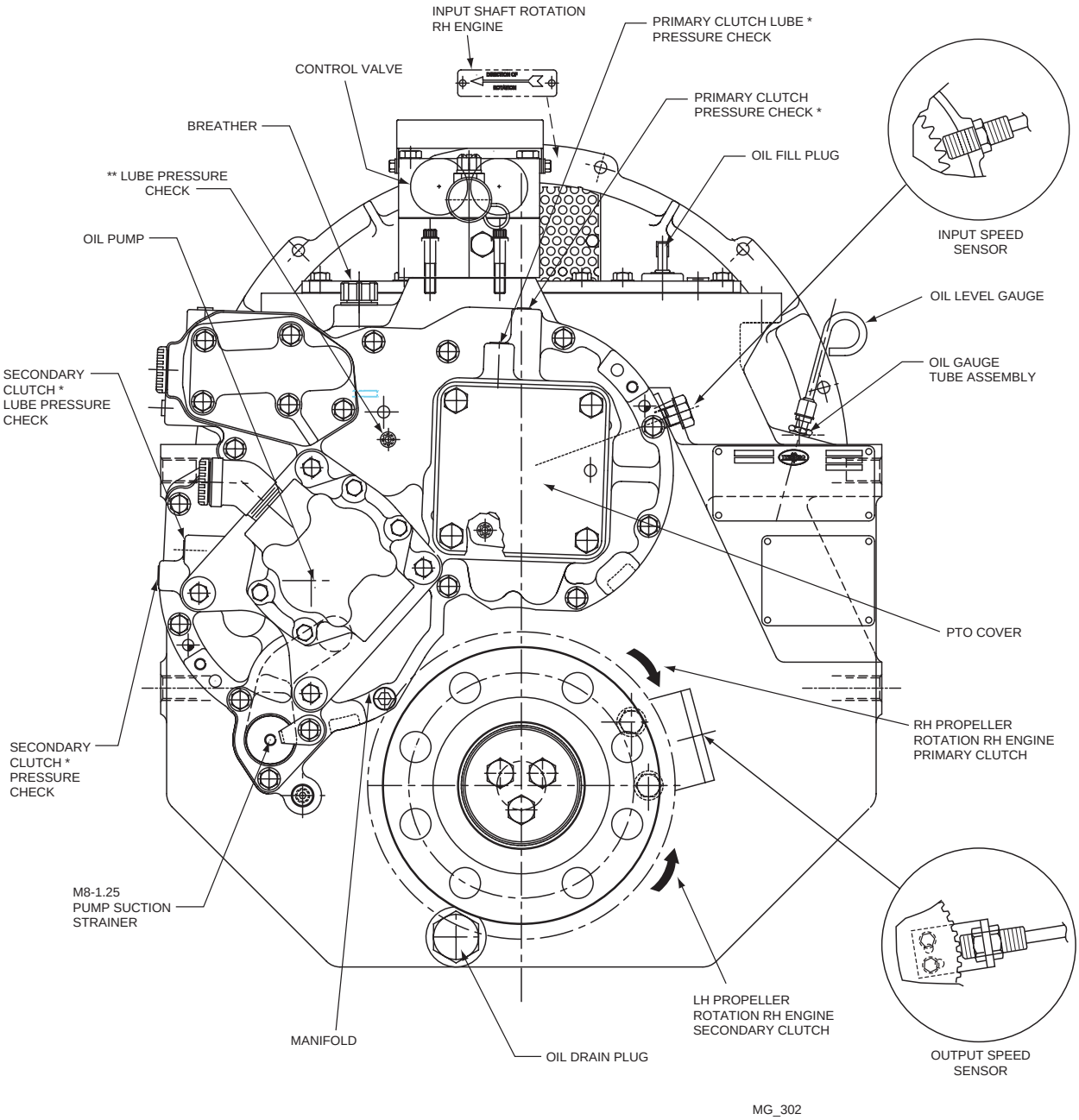


Figure 25. MG-5145A with GP Control Valve with Electronic Interface and Optional Speed Sensors

Component Identification

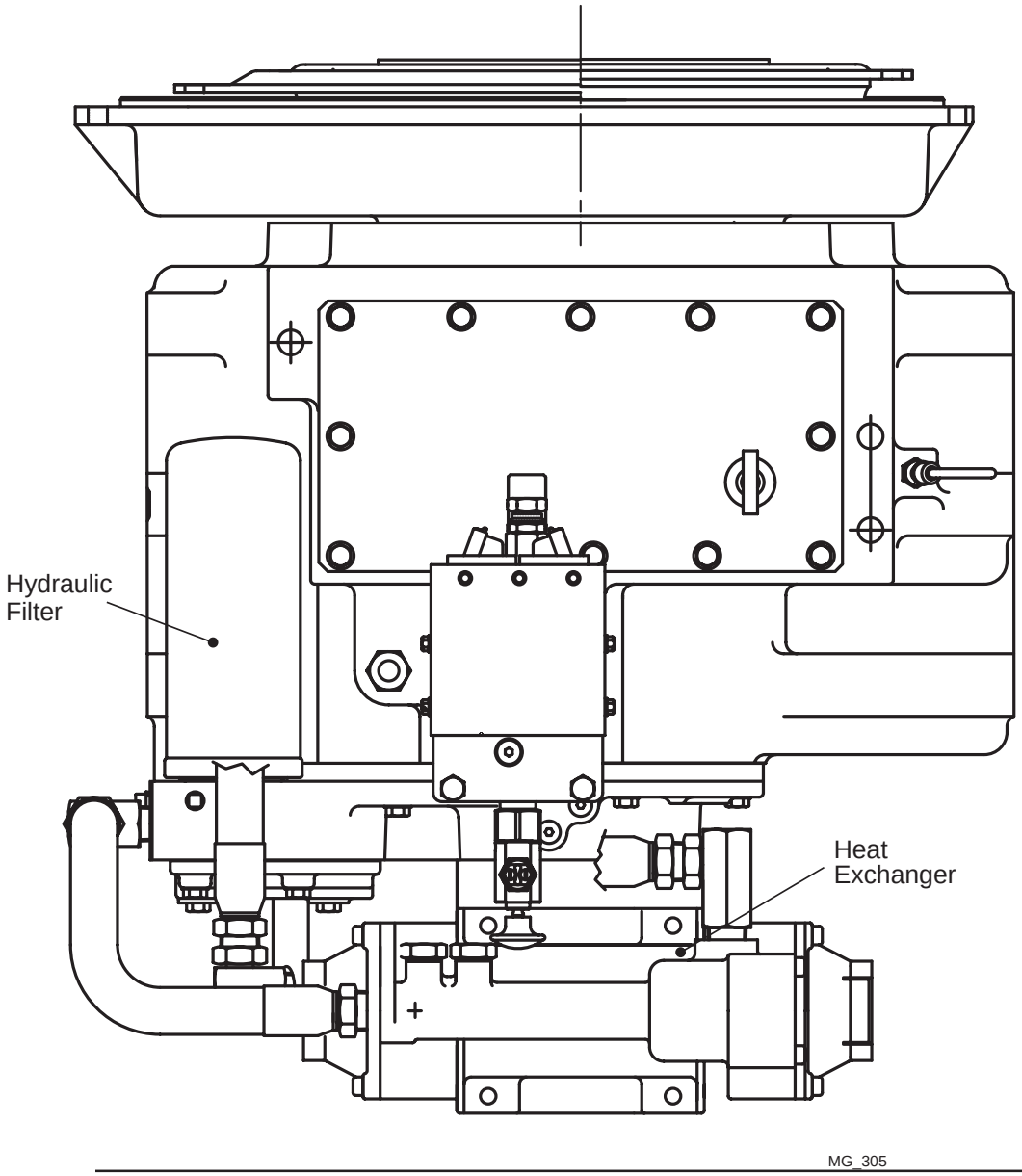
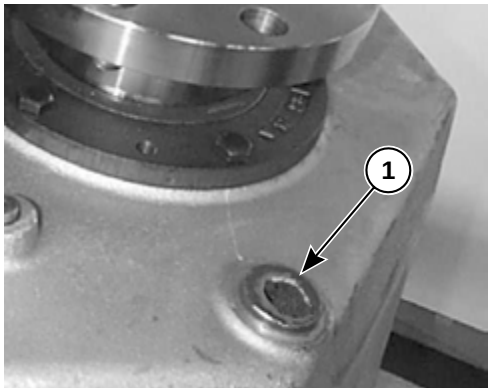


Figure 26. MG-5145A with Hydraulic Filter and Heat Exchanger

Prior to Removal

1. Remove drain plug (1) and drain oil from transmission.



MG_029

Figure 27. Drain Plug (1)

2. If equipped, disconnect the water supply hoses to the heat exchanger.

3. Mark the output flange and companion flange so they will always be assembled identically.

4. Disconnect the output and companion flanges.

5. Disconnect linkage, wiring and plumbing and remove any items that would interfere with the removal of the transmission. It may be advisable to remove the input and output speed sensors (if equipped) to avoid damaging them during transport.

6. Support the transmission with a hoist and remove the mounting capscrews.

7. Support the rear of the engine with blocks if necessary.

8. Remove the 12 capscrews that secure the transmission to the engine.

9. Push the tranmission away from the engine. Remove the transmission. Remove the input coupling from the engine flywheel.

Remove External Parts

Note: Place the main housing in the upright position to remove the following parts. Be sure the main housing is securely supported.

Input and Output Speed Sensors (If Equipped)

1. Disconnect the input speed sensor (1) and output sensor (2) connector.
2. Loosen the jam nut securing each sensor.
3. Remove the input speed sensor and the output speed sensor from the main housing.

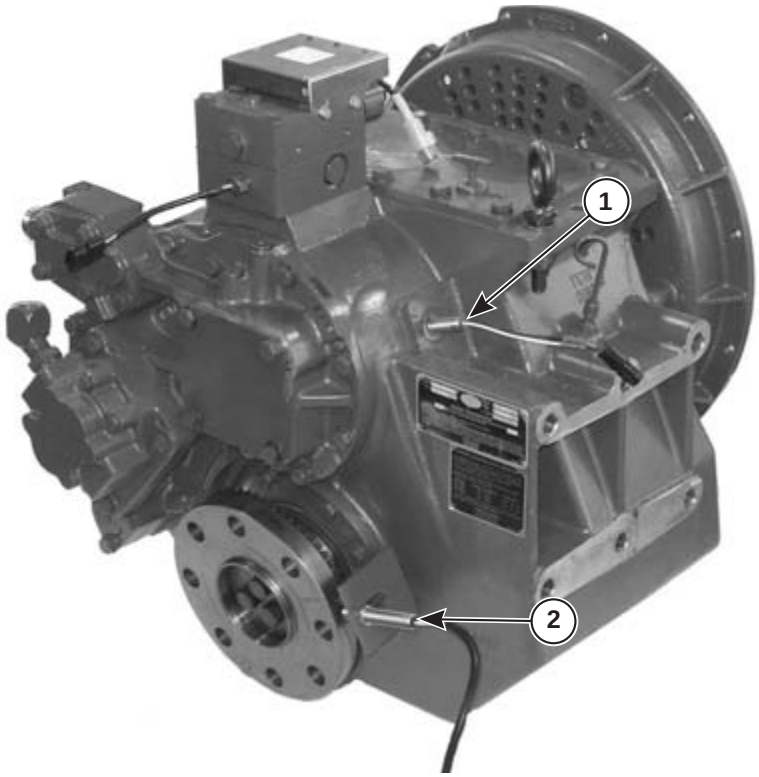


Figure 28. Input (1) and Output (2) Speed Sensor Removal

Heat Exchanger (If Equipped)

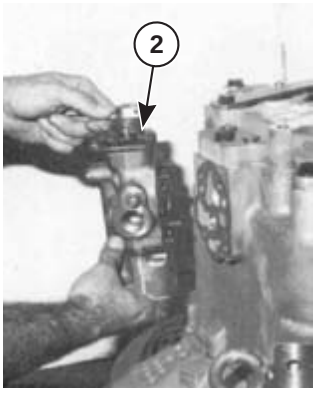
1. Remove the oil in hose connector from the fitting on the oil pump housing.
2. Remove the oil out hose from the fitting on the main housing.
3. Remove the heat exchanger from its support.
4. Remove the support from the main housing.

Control Valve

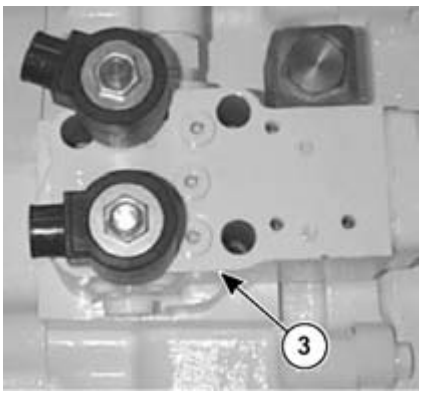
Note: To aid in assembly, be sure to mark all wire connectors prior to removing the control valve.

Mechanical Control Valve (PX-9775) - Remove the four capscrews that secure the selector valve assembly (2) to the housing and remove the selector valve assembly.

Electric Control Valve (PX-10225) - Remove the two solenoid coils. Remove the four capscrews that secure the selector valve assembly (3) to the housing and remove the selector valve assembly.



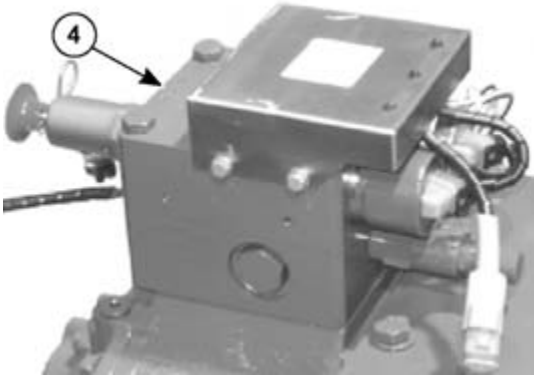
MG_200_2



MG_201_3

Figure 29. Mechanical (2) and Electric (3) Control Valve Removal

GP Control Valve with Electronic Interface (1020729) - Disconnect the wiring and remove the electronic module and six capscrews that secure the GP valve top plate to the lower plate. Remove the gasket and four capscrews that retain the assembly to the housing and remove the GP valve lower half.



MG_202

Figure 30. GP Control Valve with Electronic Interface (4) Removal

Top Cover and PTO Cover

1. Remove the twelve M12 x 30 screws with washers retaining the top cover.

2. Gently tap the top cover to break the gasket loose from the main housing.

3. Remove the top cover (1) and gasket from the transmission housing.

4. Remove the PTO cover (2).

   a. Remove the four M12 - 1.5 x 30 mm PTO cover screws.

   b. Gently tap the PTO cover, if necessary, to break the cover loose from the main housing.

   c. Remove the PTO cover and O-ring.

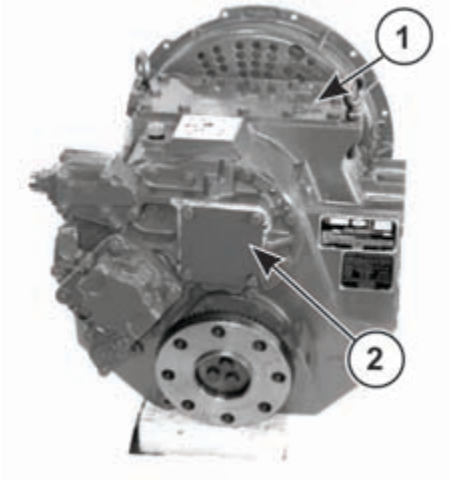


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Figure 31. Top Cover (1) and PTO Cover (2) Removal

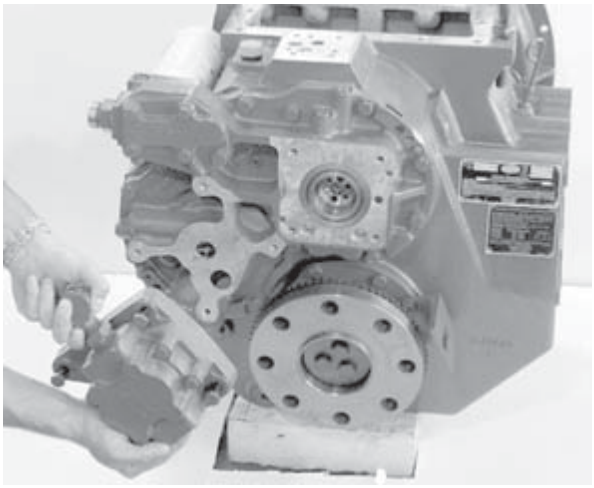
Input Coupling

1. Remove shipping wire (if equipped) retaining the input coupling to the input housing.

2. Remove input coupling from input shaft.

Hydraulic Pump

1. Remove the hydraulic pump from the main housing.



DCP_1006

Figure 32. Hydraulic Pump Removal

⚠ CAUTION

The hydraulic pump can be installed two ways; therefore, before removing the pump, place indexing marks on the pump and the manifold to ensure correct installation. Do not remove the pump pipe plug. Do not disassemble pumps. They are not serviceable.

2. Remove the five capscrews securing the hydraulic pump to manifold assembly and remove the pump and gasket.

Remove Internal Parts

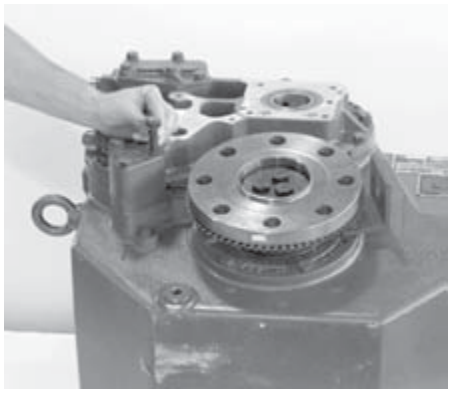
Note: Position the main housing with input end down. Be sure the main housing is securely supported.

Suction Strainer

1. Remove the M12-1.5 screw with washer directly below the suction strainer plug. Remove the clamp plate.

2. Thread a M8-1.5 screw into the suction strainer plug and pull.

3. Remove the plug and suction strainer.



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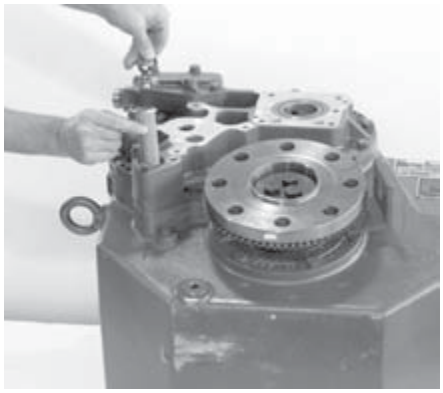

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Figure 33. Suction Strainer Removal

Oil Level Gauge

Remove the oil level tube from the main housing.

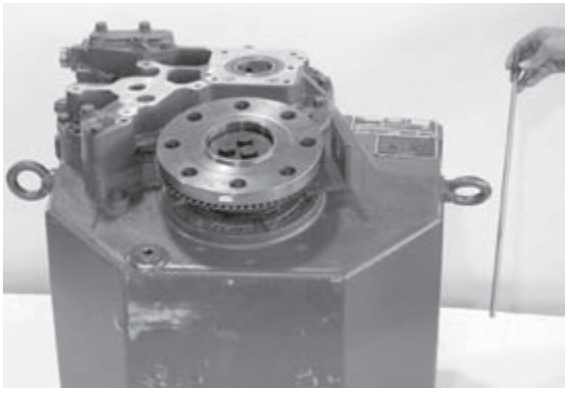

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Figure 34. Oil Level Gauge Tube Removal

Hydraulic Oil Filter

1. If equipped, remove the filter element from the manifold.

2. Remove filter bypass valve cover.

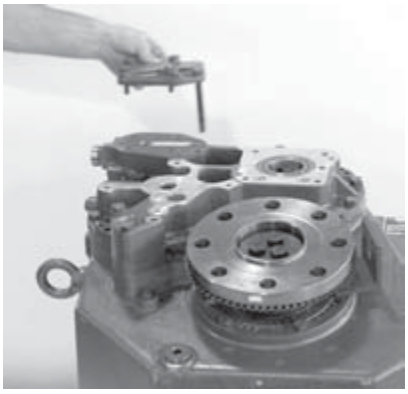

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Figure 35. Filter Element and Filter Bypass Valve Cover Removal

Output Flange

Note: The MG-5145A transmissions require the use of a SKF THAP 300 Oil Injection Kit (see Special Tools) or similar device to remove the output flange.

1. Loosen the three output flange capscrews securing the clamp plate approximately five turns. The capscrews and clamp plate will retain the output flange when it separates from the output shaft.

⚠ WARNING

Always use the retainer bolts or a safety strap to hold parts being separated with oil pressure. The parts may separate with extreme force.

2. Install the oil injector into the output flange. Note that these are special 1/4 - 19BSP threads.

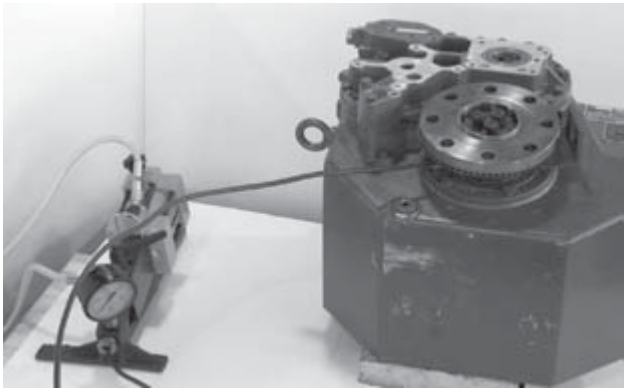

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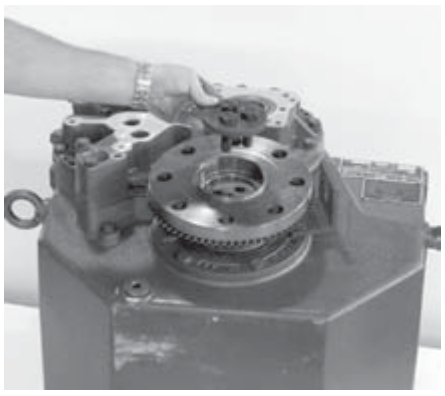
Figure 36. Clamp Plate and Output Flange Injection Location

3. Inject oil with a viscosity of 900 mm^2/S (900cSt) at room temperature into the hub until it lifts the output flange from the output shaft taper.

4. Remove the three output flange capscrews. Remove the clamp plate.

5. Remove the output flange from the output shaft.

6. Leave the output seal carrier installed to the main housing. The carrier must be in place to safely remove the output gear from the output shaft.



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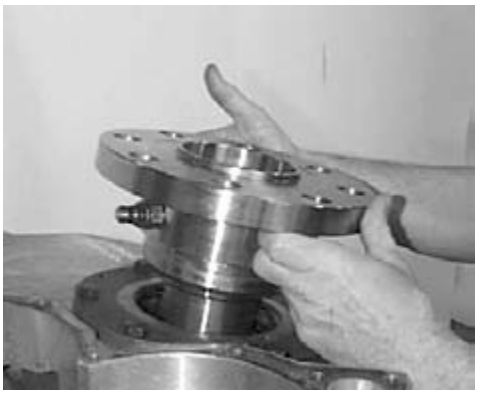

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Figure 37. Clamp Plate and Output Flange Removal

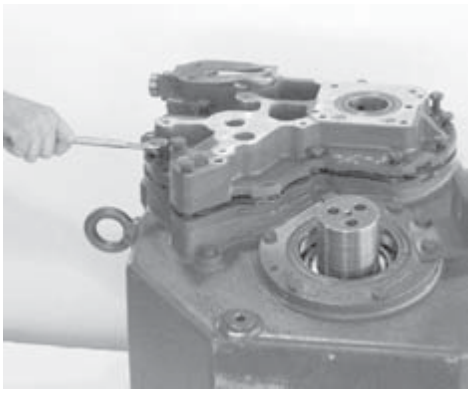
Manifold

1. Remove the screws still retaining the manifold.

2. The manifold is equipped with two pusher screw locations to assist in the removal of the manifold. Thread two M12 mm fully threaded capscrews (lubricated) into the pusher screw locations to push the manifold away from the bearing carrier.

⚠ IMPORTANT

Always lubricate the pusher screw threads before use. Always tighten the pusher screws evenly.



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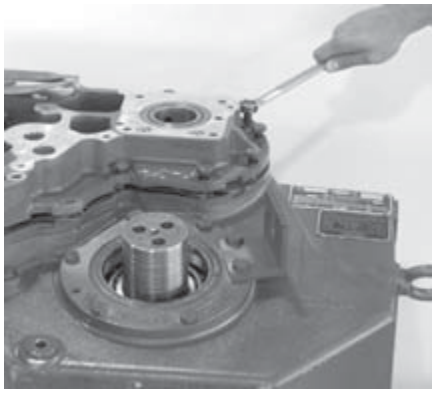

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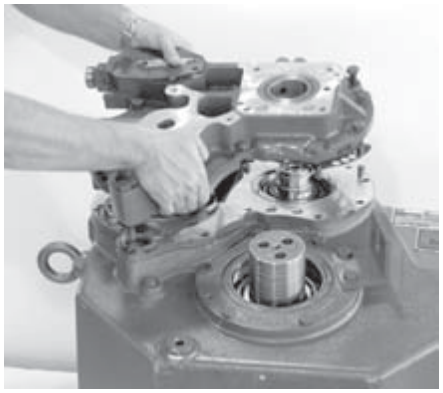
Figure38. Manifold Removal

3. Lift the manifold and gasket, taking care not to damage the piston rings on the end of the clutch shafts. Discard the gasket.



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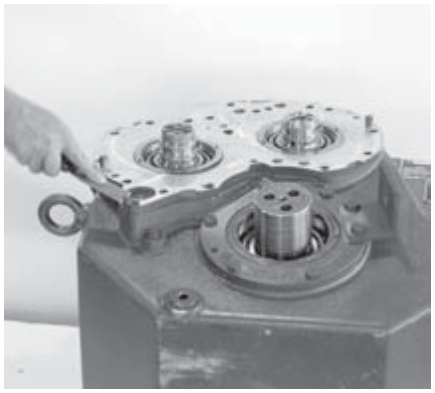

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Figure 39. Manifold Removal

4. Remove the primary clutch shaft and secondary clutch shaft piston ring bushings and O-rings from the manifold.

   Note: Only remove bushings if replacement is necessary. If removed, install new bushings during assembly.

Piston Rings

1. Remove the two piston rings from the end of the primary clutch shaft.

2. Remove the two piston rings from the end of the secondary clutch shaft.

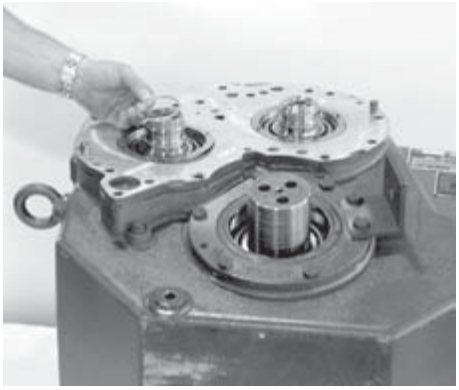

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Figure 40. Piston Rings Removal

Bearing Shims and Spacer

1. Remove the primary clutch shaft shims and spacer. Tag the components with identifying information.

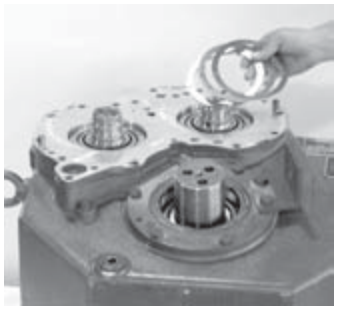

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Figure 41. Primary Clutch Shaft Bearing Shims and Spacer Removal

2. Remove the secondary clutch shaft shims and spacer. Tag the components with identifying information.

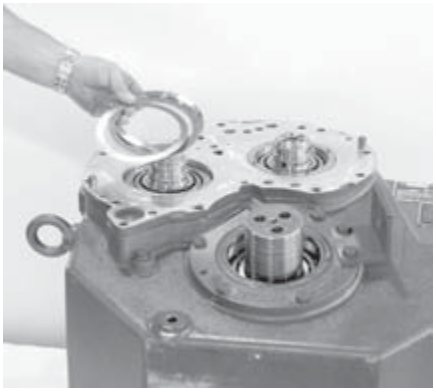

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Figure 42. Secondary Clutch Shaft Bearing Shims and Spacer Removal

Rear Bearing Carrier and Oil Lubrication Tube

1. The rear bearing carrier is equipped with two pusher screw locations to assist in the removal of the bearing carrier. Thread two M12 mm fully threaded capscrews (lubricated) into the pusher screw locations to push the bearing carrier away from the main housing. Remove the lubrication tube (1) with the bearing carrier.

⚠ CAUTION

Bearing cups are loose in bore and may drop if not handled with care.

⚠ IMPORTANT

Always lubricate the pusher screw threads before use. Always tighten the pusher screws evenly.

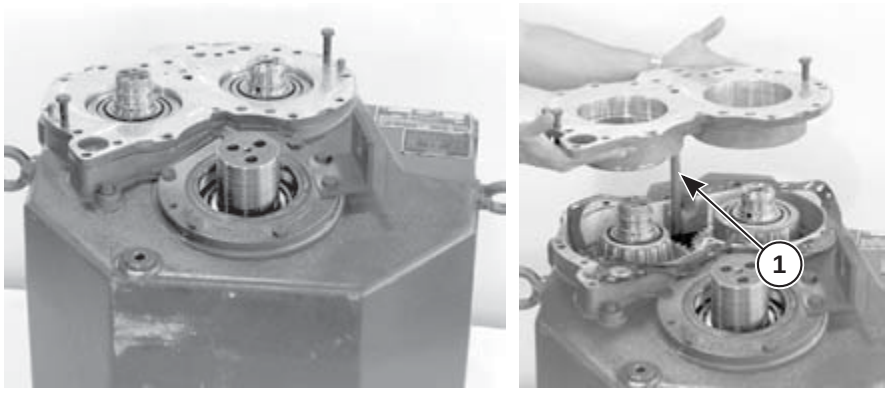

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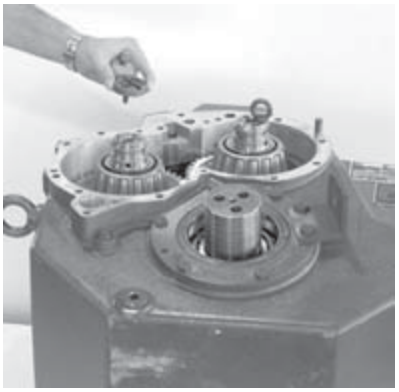
Figure 43. Rear Bearing Carrier and Oil Lubrication Tube Removal

2. Discard the bearing carrier gasket.

Primary and Secondary Clutch Shaft

1. Install a M10-1.5 lifting eye into the hole of the primary clutch.

2. Remove the socket capscrew that retains the pump drive. Install eyebolt to the output end of the secondary clutch shaft.



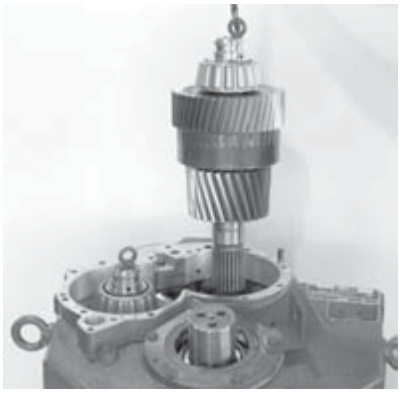
DCP_1025

Figure 44. Install Lifting Eye and Eyebolt

3. Lift the primary clutch shaft from the main housing.

4. The front bearing carrier will slide off the shaft and remain in the housing.

5. Lift the secondary clutch shaft from the main housing.
6. The front bearing carrier will slide off the shaft and remain in the housing.



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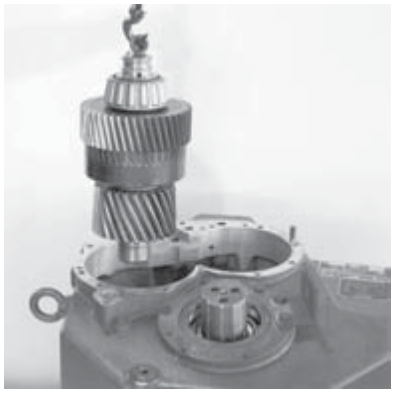

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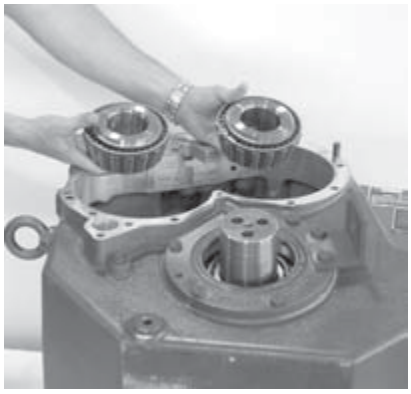
Figure 45. Primary Clutch Shaft and Secondary Clutch Shaft Removal

Front Bearing Carriers

1. Reach inside the main housing and remove the primary clutch shaft front bearing carrier. Tag the components with identifying information.

2. Reach inside the main housing and remove the secondary clutch shaft front bearing carrier. Tag the components with identifying information.



DCP_1028

Figure 46. Front Bearing Carriers Removal

Input Housing

Note: Place the main housing in the upright position to remove the following parts. Be sure the main housing is securely supported.

1. Remove the twelve M12-1.5 x 35 mm capscrews securing the input housing.

2. Remove the input housing from the main housing.

DCP_1030

Figure 47. Input Housing Cover Removal

Front Output Cover

1. Thread a M10-1.5 eyebolt into the front output cover.
2. Use a lever and a block of wood to pry on the screw to overcome the friction of the front cover O-ring.
3. Remove the front cover. Discard the O-ring.

DCP_1032

MVC_054F

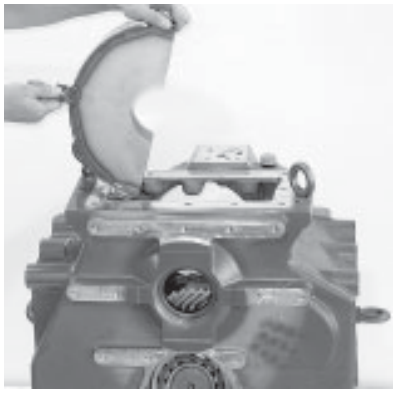
Figure 48. Front Output Cover Removal

Remove Output Gear and Shaft

Output Gear Pan

1. Remove the three capscrews with sealing washers securing the output gear pan to the main housing. The bottom capscrew is shorter.

2. Remove the output gear pan through the top opening.



DCP_1034

Figure 49. Output Oil Pan Removal

Separate Output Gear form Output Shaft

Note: The MG-5145A transmission requires the use of a SKF THAP 300 Oil Injection Kit (see Special Tools) or similar device to separate the output gear from the output shaft.

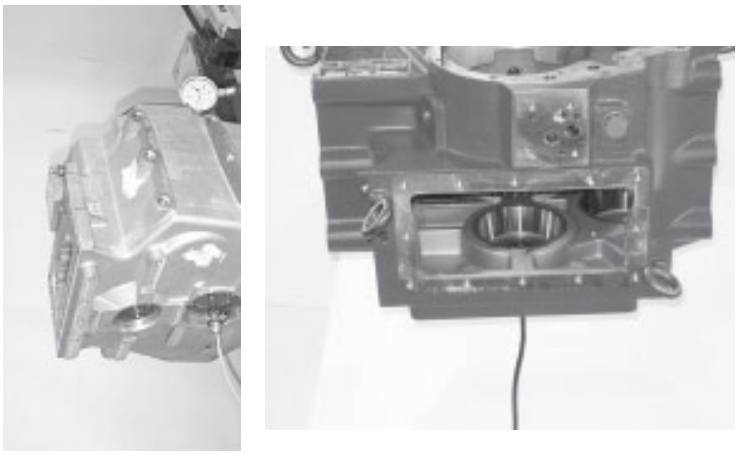
1. Place the main housing in the face down position to separate the output gear from the output shaft. Be sure the main housing is securely supported.

⚠ WARNING

Be sure the output seal carrier is installed on the main housing to hold parts being separated with oil pressure. The parts may separate with extreme force.

2. Install the oil injector into the output shaft. Note that these are special 1/4-19BSP threads.

   Note: Take precaution measures to prevent damage to the main housing when separating the output gear from the shaft. Aluminum bar stock also aids in removal of the gear from the housing.



MG_043 DCP_1035

Figure 50. Output Shaft Injection Location

3. Inject oil with a viscosity of 900 mm^2/S (900cSt) at room temperature into the output shaft until the output gear lifts from the output shaft taper.

   Note: The bearing outer race and roller usually comes out of the housing when the output gear comes off the taper.

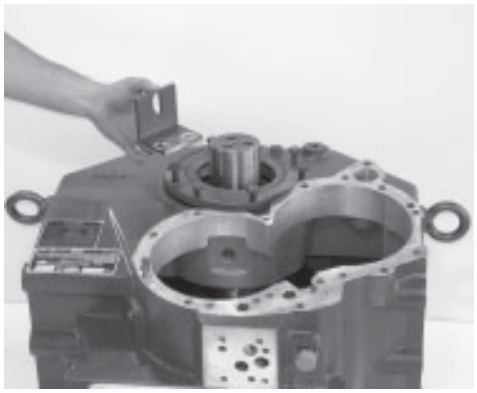
4. Lift the unit and remove the SKF fitting.

Output Shaft Seal Carrier

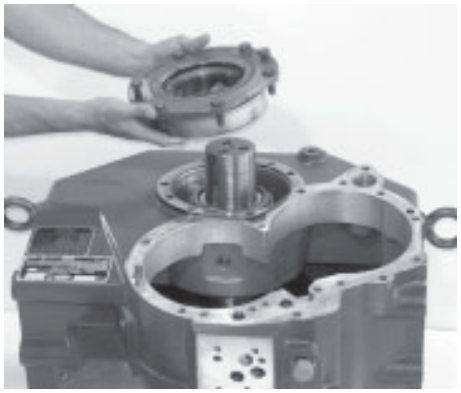
1. Position the main housing with input end down to remove the output shaft seal carrier and speed pickup bracket. Be sure the main housing is securely supported.

2. Remove the eight screws retaining the output seal carrier and speed pickup bracket.

3. Lift the seal carrier and shims from the output shaft.



DCP_1037



DCP_1038

DCP_1039

Figure 51. Output Shaft Seal Carrier Removal

4. Remove the seal from the seal carrier.

5. If the rear bearing cup needs to be replaced, remove the cup from the seal carrier.

   Note: Only remove the cup from the seal carrier if it needs to be replaced. If removed, a new bearing must be installed during assembly.

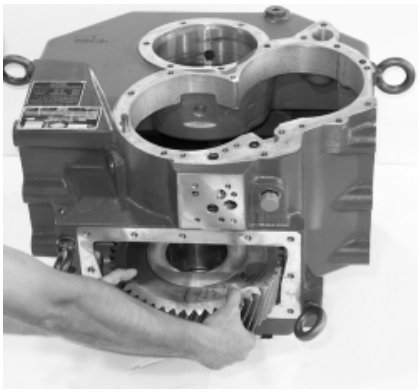
Output Shaft

1. Use a hoist and lift the output shaft from the main housing.

DCP_1040

Figure 52. Output Shaft Removal

2. Remove the output gear through the top cover opening of the main housing. Set the output gear aside.



DCP_1041

Figure 53. Output Gear Removal

Main Housing

1. Remove the input shaft seal from the main housing.

2. If replacement is necessary, remove the bearing cups for the primary and secondary clutch shafts and the output shaft. If removed, a new bearing must be installed during assembly.

   Note: Bearing cups are an interference fit in the main housing. Place a bead of weld all around the bearing face. This will cause the bearing cup to shrink so it can be removed using an internal puller.

Output Shaft Disassembly

Note: Only remove the bearing cones from the output shaft if they need to be replaced. If removed, new bearings must be installed during assembly.

Using a press, remove the rear bearing cup and cones.

MG_048

Figure 54. Output Shaft Bearing Cones Removal

Primary Clutch Shaft Disassembly

1. Remove the rear bearing cone.

   Note: Only remove the cone from the primary clutch shaft if it needs to be replaced. If removed, a new bearing must be installed during assembly.

   a. Cut off the bearing cage and remove the rollers.

   b. Use a “cheese-cutter” type puller to pull on the rear shoulder of the inner bearing race.

   c. Heat the inner race to assist in its removal.

⚠ CAUTION

DO NOT overheat the inner race as it could result in annealing the clutch shaft.

⚠ WARNING

Handle the inner race and shaft with care. The inner race and shaft is HOT.

2. Position the primary clutch shaft with the input end facing up.

3. Remove the snap ring.

DCP_1043

Figure 55. Snap Ring Removal

4. Remove the front two thrust races and needle bearing.

Note: Record location of the front two thrust races and needle bearing for proper assembly. The first race to be removed pilots on the shaft and the second one pilots in the pinion bore.

DCP_1045

Figure 56. Front Two Thrust Races and Needle Bearing Removal

5. Slide the pinion assembly from the shaft.

DCP_1046

Figure 57. Pinion Assembly Removal

6. Remove the rear two thrust races and needle bearing.

Note: Record location of the rear two thrust races and needle bearing for proper assembly. The first race removed pilots in the bore of the pinion and the second pilots on the shaft. This thrust race also has a counterbore to fit over the snap ring.

DCP_1048

MVC_763F

Figure 58. Rear Two Thrust Races and Needle Bearing Removal

7. Remove the internal snap ring and back plate from the clutch housing.

MG_051

Figure 59. Internal Snap Ring and Back Plate Removal

8. Remove the 10 steel plates and 11 friction plates from the clutch housing.

MG_052

Figure 60. Steel Plate and Friction Plate Removal

9. Position the primary shaft and clutch housing under a hydraulic press.

   a. Place Special Tool T-1802 on the spring retainer.

   b. Compress the release spring enough to expose the snap ring.

   c. Remove the snap ring.

MG_053

Figure 61. Compressing Release Spring and Snap Ring Removal

d. Carefully remove tension on the release spring.

e. Remove the spring retainer and release spring.

MG_054

Figure 62. Spring Retainer and Release Spring Removal

10. Remove the clutch piston from the clutch housing.

    a. Thread two M8-1.25 mm rods into the piston 180° apart. Lift clutch piston out of the clutch housing. Compressed air can be used to aid in the removal of the piston.

    b. Remove the O-ring from the inside diameter of the piston.

    Note: DO NOT disassemble the clutch shaft from the clutch housing. These parts are not serviced separately.

MG_302

Figure 63. Piston and O-ring Removal

Secondary Clutch Shaft Disassembly

1. Remove the rear bearing cone.

   Note: Only remove the cone from the secondary clutch shaft if it needs to be replaced. If removed, a new bearing must be installed during assembly.

   a. Cut off the bearing cage and remove the rollers.

   b. Use a “cheese-cutter” type puller to pull on the rear shoulder of the inner bearing race.

   c. Heat the inner race to assist in its removal.

⚠ CAUTION

DO NOT overheat the inner race as it could result in annealing the clutch shaft.

⚠ WARNING

Handle the inner race and shaft with care. The inner race and shaft are HOT.

2. Position the secondary clutch shaft with the input end facing up.

3. Remove the snap ring.

DCP1043

Figure 64. Snap Ring Removal

4. Remove the front two thrust races and needle bearing.

Note: Record location of the front two thrust races and needle bearing for proper assembly. The first race to be removed pilots on the shaft and the second one pilots in the pinion bore.

DCP_1045

Figure 65. Front Two Thrust Races and Needle Bearing Removal

5. Slide the pinion assembly from the shaft.

DCP_1046

Figure 66. Pinion Assembly Removal

6. Remove the rear two thrust races and needle bearing.

Note: Record location of the rear two thrust races and needle bearing for proper assembly. The first race removed pilots in the bore of the pinion and the second pilots on the shaft. This thrust race also has a counterbore to fit over the snap ring.

DCP_1048

MVC_063F

Figure 67. Rear Two Thrust Races and Needle Bearing Removal

7. Remove the internal snap ring and clutch back plate from the clutch housing.

MG_051

Figure 68. Internal Snap Ring and Clutch Back Plate Removal

8. Remove the 10 steel plates and 11 clutch friction plates from the clutch housing.

MG_052

Figure 69. Steel Plate and Clutch Friction Plate Removal

9. Position the secondary shaft and clutch housing under a hydraulic press.

   a. Place Special Tool T-18502 on the spring retainer.

   b. Compress the release spring enough to expose the snap ring.

   c. Remove the snap ring.

MG_053

Figure 70. Compressing Release Spring and Snap Ring Removal

   d. Carefully remove tension on the release spring.

e. Remove the spring retainer and release spring.

MG_054

Figure 71. Spring Retainer and Release Spring Removal

10. Remove the clutch piston from the clutch housing.

    a. Thread two M8-1.25 mm rods into the piston 180° apart. Lift the clutch piston out of the clutch housing. Compressed air can be used to aid in the removal of the piston.

    b. Remove the O-ring from the inside diameter of the piston.

    c. Remove the piston ring from the outside diameter of the piston.

    Note: DO NOT disassemble the clutch shaft from the clutch housing. These parts are not serviced separately.

MG_306

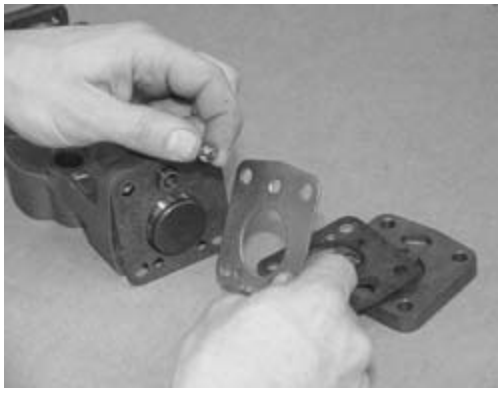
Figure 72. Piston and O-ring and Piston Ring Removal

Mechanic Control Valve Disassembly (PX-9975)

⚠ CAUTION

Steel ball is under pressure from the spring. Care must be taken when removing the cover and orifice plate to prevent loss of steel ball.

1. Remove the orifice plate cover, the orifice plate, and check ball.



MG_224

Figure 73. Removing Orifice Plate and Check Ball

2. Remove the check ball spring and shim(s) from the valve body.

MG_225

Figure 74. Removing Check Ball Spring

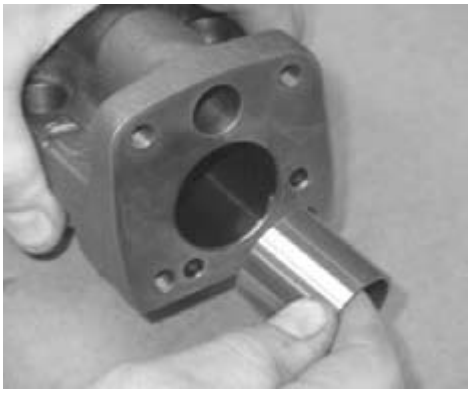
3. Remove the rate-of-rise piston and remove adjustment shims.

MG_226

Figure 75. Removing Shims from Rate-of-Rise Piston

4. Remove the pressure regulating springs and pressure regulator piston.

MG_227



MG_228

Figure 76. Removing Regulator Springs and Regulator Piston

5. Remove the O-ring plug, detent spring and detent ball.

MG_229

Figure 77. Removing O-ring Plug, Detent Spring and Ball

6. Mark the lever and the stem to indicate the position the lever was installed on the stem. Loosen the screw clamping the lever to the stem and remove the lever. It may be necessary to spray the lever with penetrating lubricant to be able to remove it. **DO NOT** apply any impact force to the lever, as the stem, lever or bearing might get damaged.

MG_229

Figure 78. Removing Lever

7. Remove the cover and stem together as a unit.

MG_231

Figure 79. Removing Stem and Cover Together

8. Mark the stop collar and the stem to indicate the position the collar was installed on the stem. While supporting the collar, drive the roll pin out of the collar with a drift punch and remove the collar.

MG_232

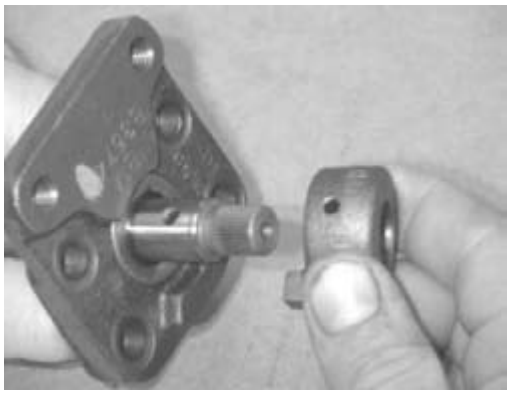

MG_233

Figure 80. Removing Roll Pin and Stop Collar

9. Slide the stem out of the cover.

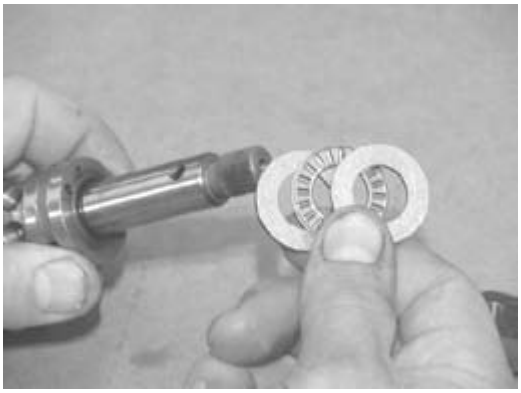
10. Remove the oil seal from the cover.

11. Remove the O-ring from the stem.

MG_234

Figure 81. Removing O-ring from Stem

12. Remove the thrust bearing and races from the stem.



MG_235

Figure 82. Removing Thrust Bearing and Races from Stem

13. Remove the remaining plugs from the valve body.

Electric Control Valve Disassembly (PX-10225)

1. Remove the solenoid retaining nuts and remove the solenoids from the spools.

2. Remove the solenoid spools.

Figure 83. Solenoid Components

3. Remove the capscrew that retains the override valve assembly to the valve body. Slide assembly off rollpin.

4. Remove the override valve cartridge from the body if necessary.

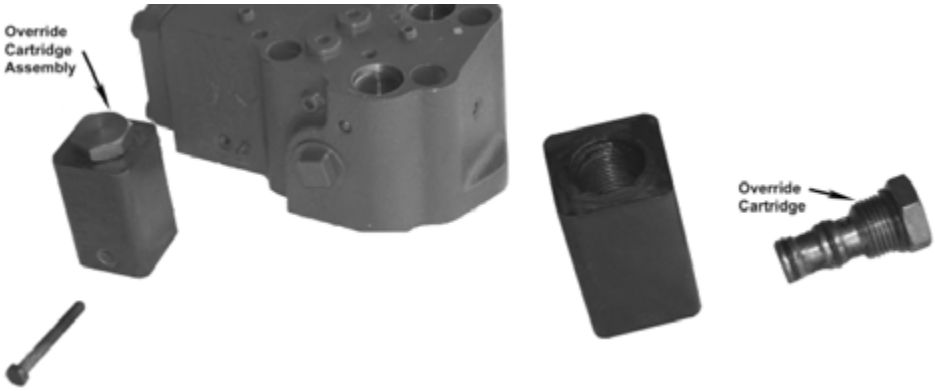


Figure 84. Override Valve Cartridge Assembly

5. Remove the four screws that retain the end plate and ball seat plate to the valve body.

6. Remove the check ball and spring.

7. Remove the rate-of-rise piston, springs (with any shims that may be included in the rate-of -rise piston), and inner cup.

8. Remove the rate-of-rise orificed plug if necessary.

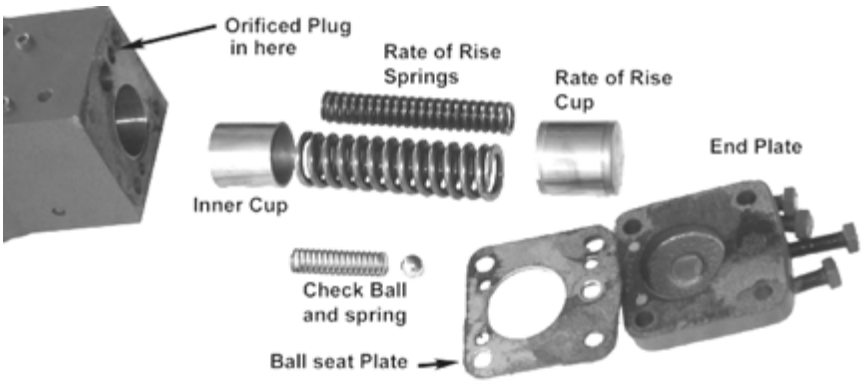


Figure 85. Rate-of-Rise Components

9. Remove the plug and spacers, and the shuttle ball seat and ball. Make sure the O-ring is removed from the bore if it does not remain on the ball seat.

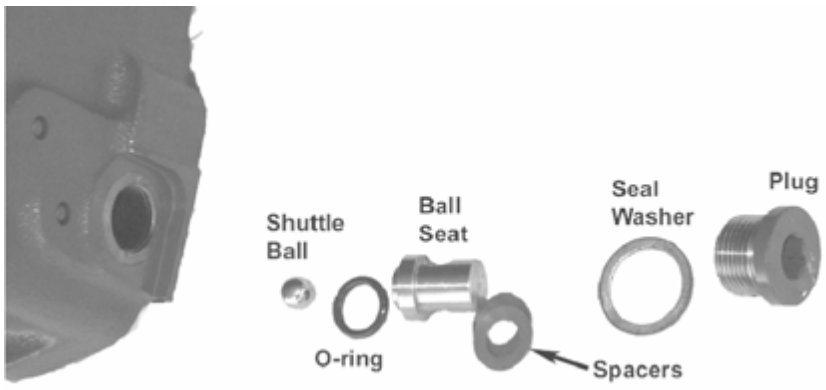


Figure 86. Shuttle Ball and Components

Disassembly of GP Control Valve with Electronic Interface

The GP Valve is made up of a non serviceable electronic interface, and two valve bodies with plugs and cartridges. O-ring kits are available for servicing the plugs and cartridges, however none of the cartridges are field serviceable beyond replacement of the o-rings. The later version (Assembly 1021658) of the hydraulic pressure regulator valve is serviceable, and contains an orifice/ filter plug, and a ball check valve assembly that are replaceable.

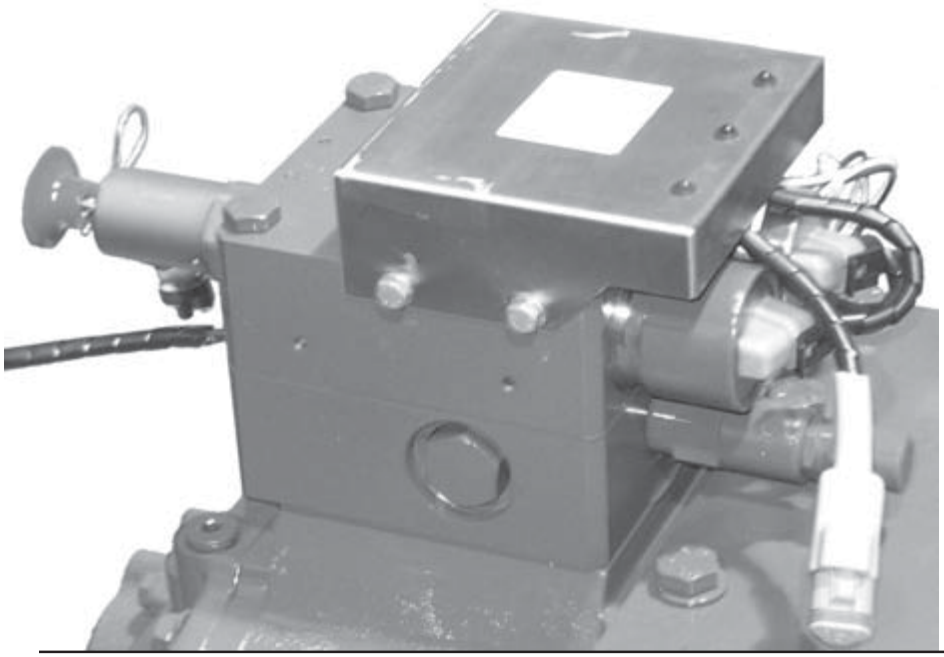


Figure 87. GP Valve Assembly mounted on Marine Transmission.

Disassembly

1. Disconnect the connectors at the proportional valves, the neutral switch, and the temperature sensor (if equipped), and loosen the four M6-1.0 capscrews that retain the Electronic Interface Module to the Hydraulic portion of the valve assembly. If the Electronic Interface is not being replaced, it can be set aside without disconnecting the remaining wires from the installation.

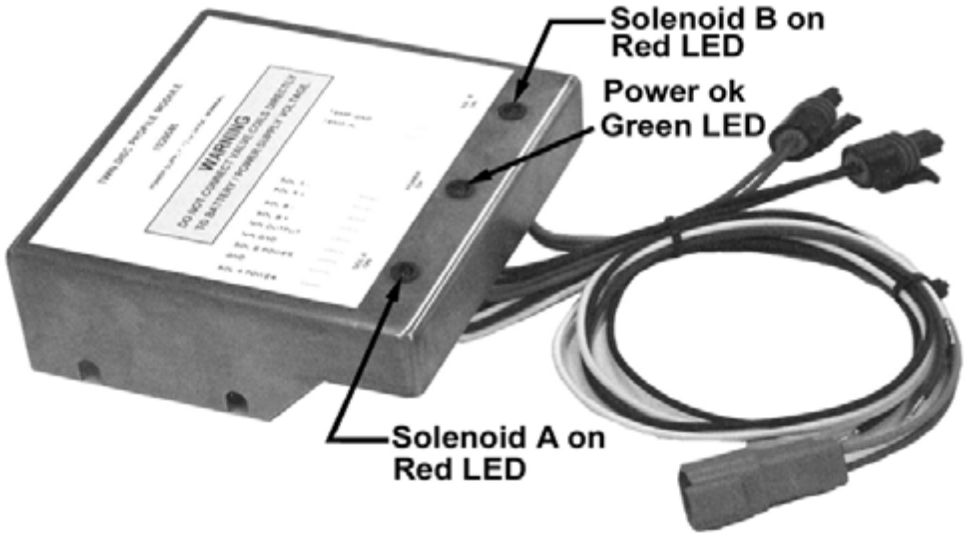


Figure 88. Electronic Profile Module (typical)

2. Remove the six M10-1.50 x 70 capscrews that retain the top valve body assembly to the transmission, and remove the top valve body assembly with gasket (if not previously removed).

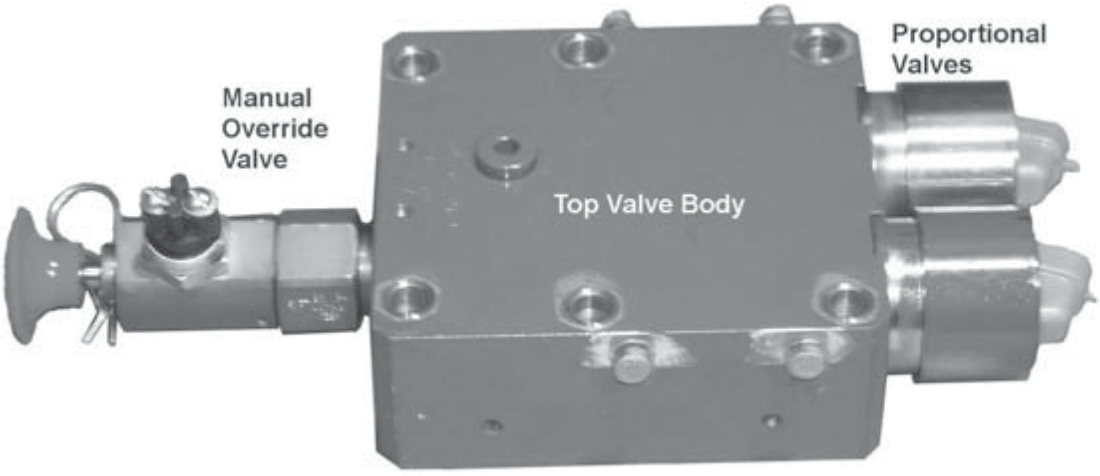


Figure 89. Top Hydraulic Valve Body Assembly

3. Remove the four capscrews that retain the main regulator valve assembly to the transmission housing or ditch plate, and remove the valve assembly and gasket.

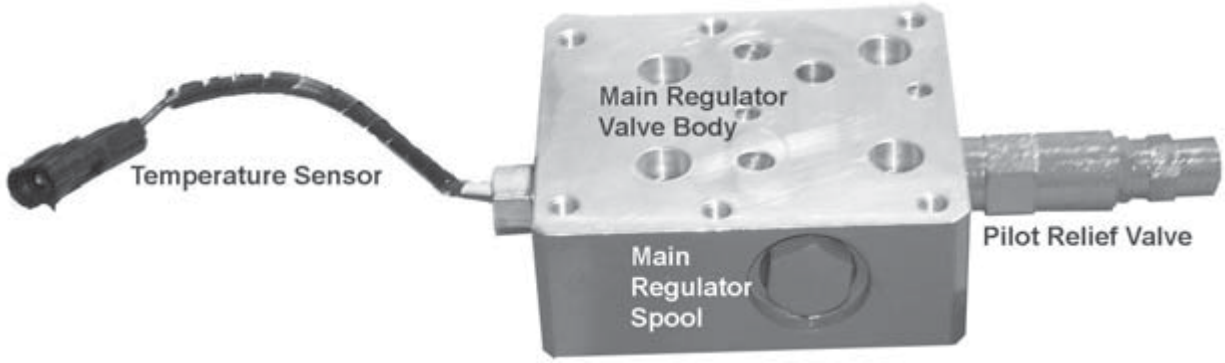


Figure 90. Main Regulator Hydraulic Valve Assembly (1020729)

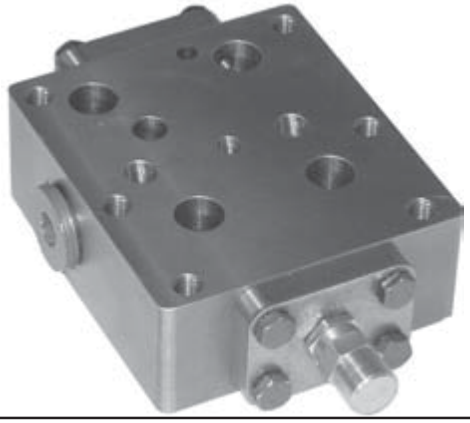


Figure 91. Main Regulator Hydraulic Valve Assembly (1021658)

4. Remove the manual direction control valve with switch or the plug assembly from the top valve body.

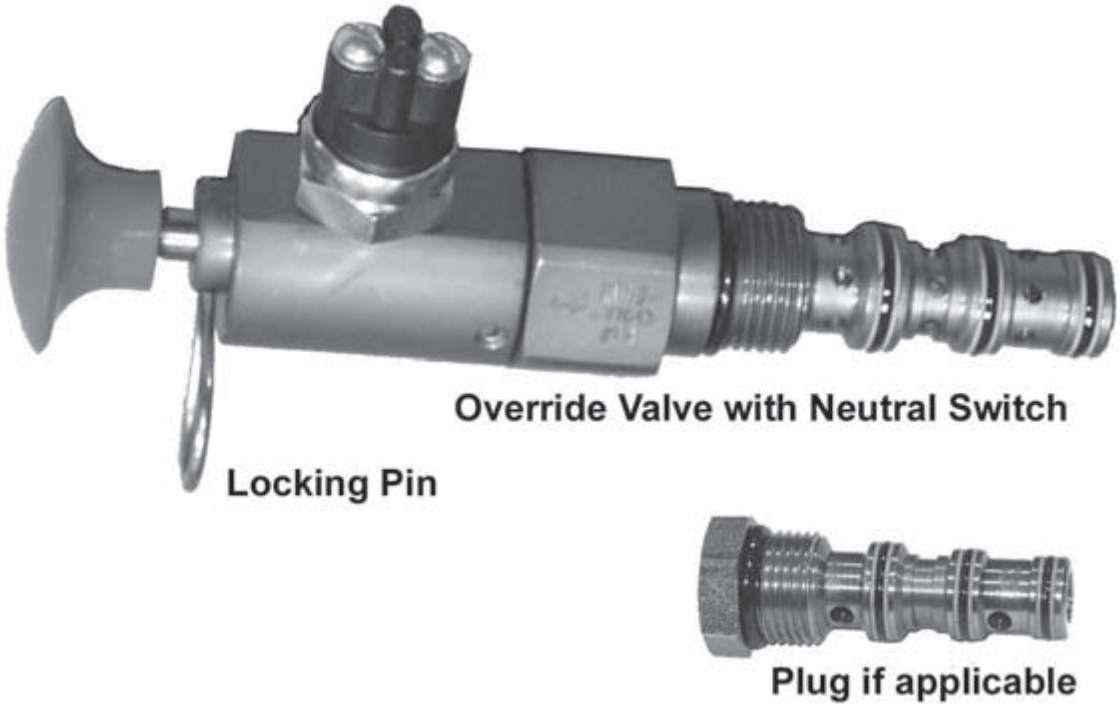


Figure 92. Manual Direction Control Valve or Plug

5. Remove the M6-1.00 x 16 Allen head capscrew, the retaining plate, and the proportional valve cartridges from the top valve body. A slight rotating motion while pulling will help to with the removal of the valves.

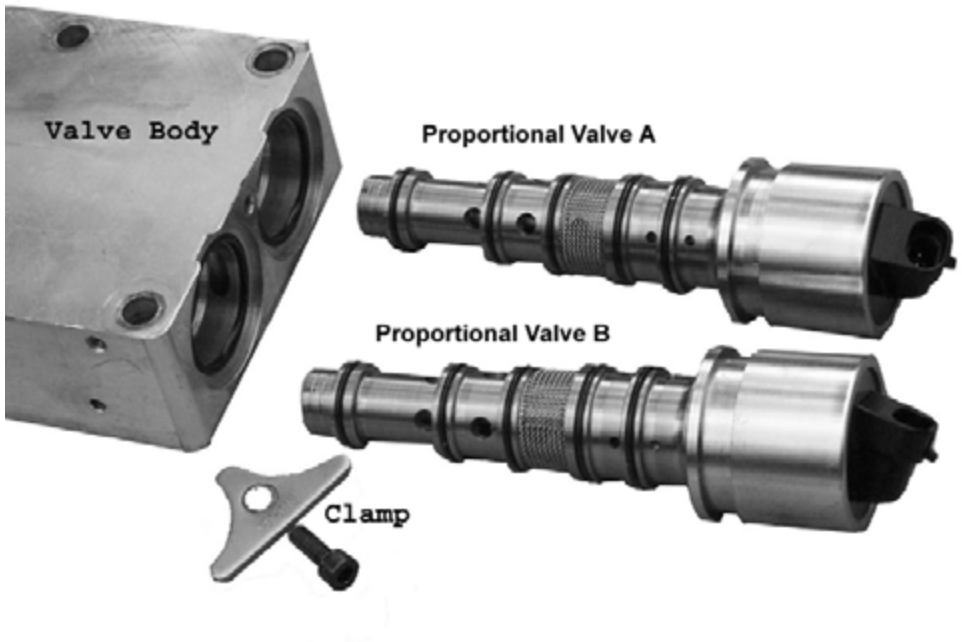


Figure 93. Remove Proportional Valve Cartridges

6. **Valve Assembly 1020729:** Remove the main pressure regulator pilot relief valve and main valve from the main regulator valve body.

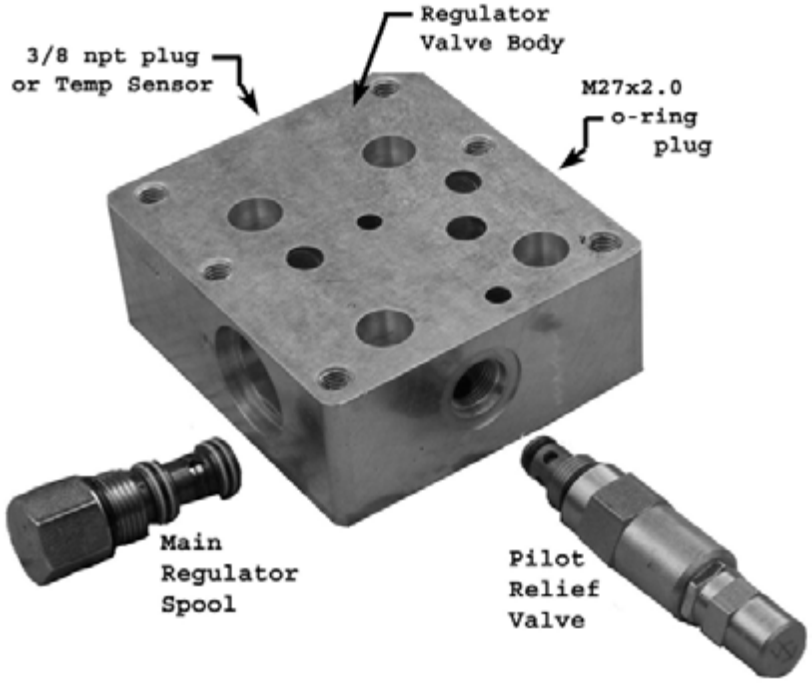


Figure 94. Remove Main Pressure Regulator Valve Components

6. **Valve Assembly 1021658:** Remove the main pressure regulator from the main regulator valve body.

   a. Remove the regulator adjusting screw cap, and loosen the jam nut.

   b. Turn the adjusting screw counter clockwise to reduce the spring load on the valve.

   c. Evenly loosen the four M-8 x 25 capscrews, and remove the cover assembly and gasket, followed by the spring(s) and spool.

   d. Remove the four M-8 x 20 capscrews, and remove the cover and gasket.

   e. Remove the orifice and screen assembly for cleaning.

   f. Remove the ball check assembly only if necessary. Removal will require destruction and replacement of the assembly.

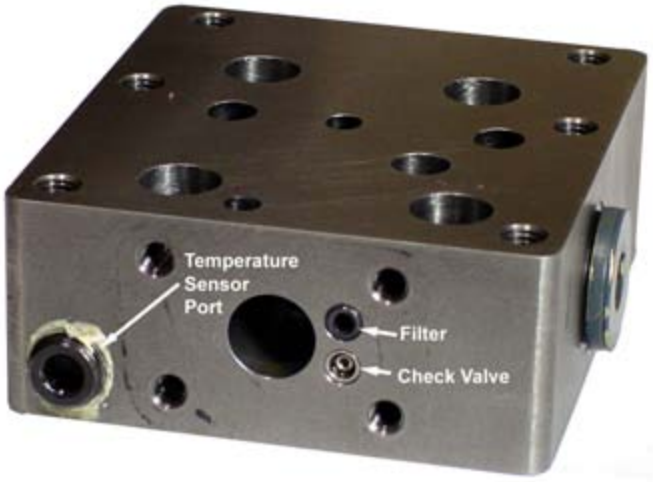


Figure 95. Remove Main Pressure Regulator Valve Components

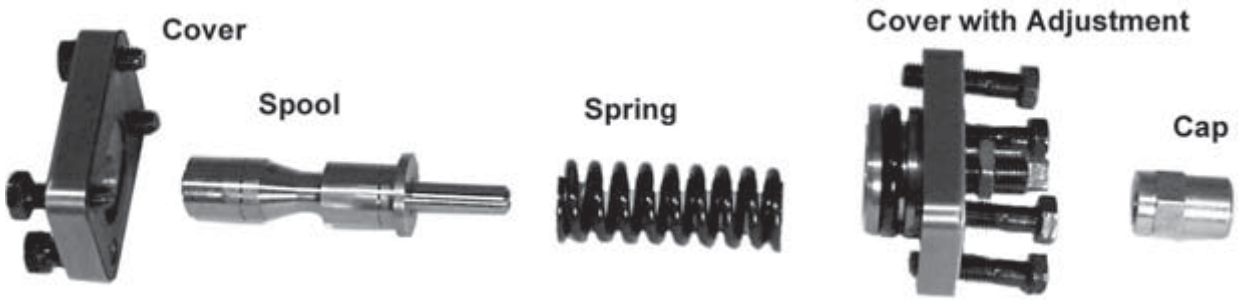


Figure 96. Remove Main Pressure Regulator Valve Components

Trolling Valve Disassembly (Optional Equipment)

1. Remove the four screws that attach the manifold and trolling valve to the control valve body.

1367

Figure 97. Removing Manifold Assembly Attaching Screws

Note: Rotate the trolling valve handle counter clockwise, out of the detent position to lessen the spring force on the valve seat before removing screws.

2. Remove the trolling valve from the manifold.

1370

1377

Figure 98. Remove Trolling valve and gasket

3. Remove the gasket, valve plunger, and spring from the trolling valve.

4. Remove the detent setscrew, spring, and detent ball.

5. Be sure the trolling valve stem is in its furthest out position. Support the valve body, and the pins through the valve body, nd out the other side.

1383 1386

Figure 99. Drive the pins through the hole in the valve and body

6. Remove the screw and nut clamping the lever to the stem.

7. Remove the lever from the stem. It may be necessary to splay the lever to be able to remove it. **DO NOT** apply any impact force to the lever as the stem might get damaged.

1380

Figure 100. Removing the valve handle

8. Slide the stem out of the valve body. Push the stem out of the valve body such that the spring end of the stem exits the valve body first. Note that the inner spring will come out with the stem.

1389

Figure 101. Removing the Stem from the valve body

9. Remove the O-ring from the groove in the end of the stem.

MG_250

Figure 102. Removing O ring from the valve stem

10. Remove the inner spring and roll pin from the stem only if replacement of parts is necessary.

11. Remove the washer from the bore of the valve body (some models).

Note: The washer may have been removed with the stem.

12. Remove the oil seal from the end of the valve body.

1388

Figure 103. Trolling valve parts

NOTES

Cleaning and Inspection

Cleaning

Note: Replace all oil seals, gaskets, O-rings piston rings, seal rings, snap rings, etc., as a part of any maintenance or overhaul procedure. Replace shims that are damaged or destroyed in disassembly.

- ❑ Clean all parts using EPA/OSHA approved solvents or by steam cleaning. Parts must be dried and oiled immediately to prevent corrosion.
- ❑ Examine all parts carefully for grit, dirt and abrasives and reclean them if necessary.
- ❑ Clean all oil passages by working a piece of wire back and forth through the passages and then flushing them with cleaning solvent.
- ❑ Use clean solvent to flush oil pumps, valves, etc.
- ❑ Flush all hoses, tubing, coolers etc., particularly if the unit is being disassembled because of an internal failure.
- ❑ De-burr the housing and bearing carrier with a stone or file in the vicinity of all pusher screw locations.

Cleaning Bearings

DO NOT remove grease in which new bearings are packed. Thoroughly wash bearings that have been in service. Soak bearings in solvent if they are particularly dirty or filled with hardened grease.

⚠ CAUTION

Never dry bearings with compressed air. Do not spin unlubricated bearings. Oil bearings with SAE 10 engine oil immediately after cleaning. Oil bearings before inspection.

Preventing Dirt from Entering into Bearings

Dirt and grit in bearings are often responsible for bearing failure; consequently, it is important to keep bearings clean. Do not remove grease from new bearings. Keep the wrapper on new bearings until they are installed. Do not expose clean bearings if they are not to be assembled at once. Wrap them with a clean lint-free cloth or paper to keep out dust.

Previously Sealed Joints

- ❑ For previously sealed joints, scrape surfaces to remove old gasket material or Loctite™.
- ❑ Clean surfaces with solvent to remove oil and grease residue.
- ❑ Test for clean surfaces by applying a few drops of cool water to the surfaces. Parts are sufficiently clean if water covers the surface in a film. If the water puddles or forms beads, use fresh solvent and reclean.

Inspection

Housings, Cast Parts, and Machined Surfaces

- ❑ Replace cast parts or housings that are cracked.
- ❑ Inspect bores for wear, grooves, scratches and dirt. Remove burrs and scratches with crocus cloth or soft stone. Replace deeply grooved or scratched parts. Do not remove excess material by sanding or grinding. This will cause loss of fit of bearings or races.
- ❑ Inspect oil passages for obstructions. If you find an obstruction, remove it with compressed air or work a wire back and forth through the passage and flush it with solvent.
- ❑ Inspect machined surfaces for burrs, scratches, nicks and foreign matter. If you cannot remove the defect with crocus cloth or a soft stone, replace the part.
- ❑ Inspect ground tapers for scratches, galling or scoring damage. If any of these are present, replace the part.
- ❑ Inspect ground tapers for burrs or nicks. If you cannot remove the defect with a soft stone, replace the part.
- ❑ Inspect threaded openings for damaged threads. Chase damaged threads with a tap of the correct size.
- ❑ Inspect studs for damaged threads and looseness. Replace defective studs.
- ❑ Inspect dowel pins for wear or damage. Replace defective dowels.
- ❑ Inspect dowel pin holes for wear due to movement between mating parts. If a dowel pin hole is worn, re-bore and sleeve the hole when possible. Otherwise, replace the parts. This applies where a matched set of parts is not involved.

Valve Seats

Inspect valve seats for burrs, nicks and scratches. If you cannot remove these defects with a crocus cloth, replace the part. Check to see that the valve is seating properly after reworking the valve seat.

Bearings

- ❑ Inspect bearings for roughness of rotation. Replace the bearing if the rotation is rough.
- ❑ Inspect bearings for corrosion, and for indication of wear of balls or rollers. Inspect for scored, scratched, cracked, pitted or chipped races. If you find one of these defects, replace the bearing.
- ❑ Inspect bearing bores and shafts for grooved, burred, or galled conditions that would indicate the bearing has been turning in its housing or on its shaft. If you cannot repair the damage with a crocus cloth, replace the part.

Bushings and Sleeves

Inspect bushings for size and out-of-roundness. Inspect for scores, burrs, sharp edges, and evidence of overheating. Remove scores with a crocus cloth. If the bushing is out-of-round, deeply scored, or excessively worn, replace it.

Thrust Washers and Spacers

Inspect thrust washers for distortion, scores, burrs and wear. Rework or replace any defective thrust washers or spacers.

Gears

- ❑ Inspect gears for scuffed, nicked, burred or broken teeth. If you cannot remove the defect with a soft stone, replace the gear.
- ❑ Inspect gear teeth for wear that may have destroyed the original tooth shape. If you find this condition, replace the gear.
- ❑ Inspect thrust faces of gears for scores, scratches and burrs. If you cannot remove these defects with a soft stone, replace the gear.

Splined Parts

Inspect splined parts for stripped, twisted, chipped or burred splines. Remove burrs with a soft stone. Replace the part if other defects are found.

Springs

Inspect springs for broken or distorted coils. Replace the spring if either of these defects is found.

Flexible Hoses

Inspect all flexible hoses for cracks and sponginess. Replace damaged hoses.

Clutch Plates

Inspect clutch plates for signs of overheating, pitting, or excessive wear of the friction and splined surfaces. Replace the clutch plates if one of these defects is found. Refer to wear limits in Description and Specifications.

NOTES

Assembly

General

During service of this unit, all O-rings, gaskets and seals **must be** replaced.

Refer to cleaning and inspection information in this manual prior to assembly. It is good practice to compare the new parts with those being replaced during the assembly process (to make sure you don't mistake the quantity or size).

Flat washers are used under all fasteners where the head of the fastener contacts an aluminum surface.

Unless otherwise specified, all torque values listed are for capscrews that have been lubricated on the threads and contact surfaces.

Pipe threads called out as PT (British Standard Pipe Tapered) on drawings and in this text are different from NPT threads. PT threads and NPT threads are NOT interchangeable. Adapters are available from several manufacturers to convert PT threads to NPT threads.

Where grease is specified, use a lithium based grease (NLGI 2).

Submerge all new clutch friction plates in clean transmission oil for a minimum of one hour prior to installation.

This transmission uses liquid sealer in many locations. The approved sealant is Loctite® 518 (MA1015), applied per S774 (a thin layer of sealant is all that is required), with Locktite® Primer N (MA1012). Avoid getting sealant into the O-ring counter bores.

This transmission uses thread lockers MA908 and MA1007 at specified capscrew locations.

Note: In the discussion that follows, the input side of the transmission is the front and the output side is the rear. Left and right sides are determined by facing from the rear toward the front.

⚠ CAUTION

Appropriate eye protection must be worn during transmission assembly. To avoid personal injury, proper safety equipment must be used during installation of any heated bushings, bearings and other components.

Primary Shaft Assembly

1. If removed, install a new rear taper bearing cone on the output end of the shaft.

   a. Heat the bearing cone to 120°C (250°F).

⚠ WARNING
Handle the bearing cone with care. The bearing cone is HOT.

   b. Place the bearing cone on the clutch shaft and push it firmly into position against the clutch housing.

   Note: Be sure to seat the bearing cone against the clutch housing as the bearing cools.

2. Install the clutch piston into the clutch housing.

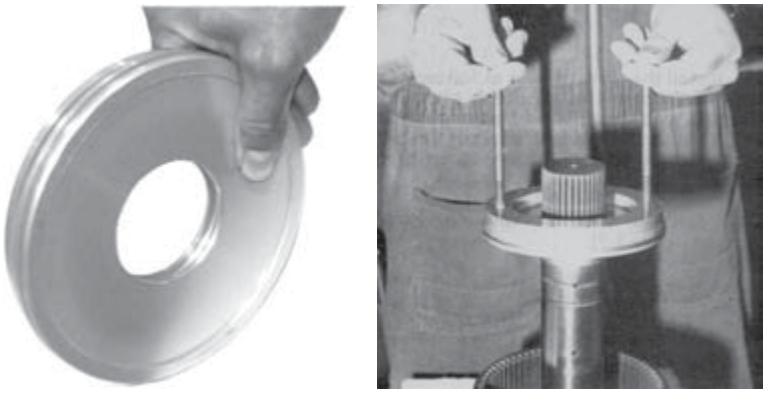
   a. Lubricate and install a new piston ring on the outside diameter of the clutch piston.

   b. Lubricate and install a new O-ring in the inside diameter of the clutch piston.

   c. Thread the two M8-1.25 mm rods into the clutch piston.

   d. Lubricate the clutch piston bore with a thin film of grease. Install the clutch piston into the clutch housing.

   Note: If the clutch piston is difficult to install by hand, remove the clutch piston and inspect the piston rings.



MG_306 DCP_2000

Figure 104. Piston Ring, O-ring and Clutch Piston Installation

3. Position the primary clutch shaft under a hydraulic press.

   a. Slide the release spring over the shaft.

   b. Place the spring retainer on the release spring.

   c. Use Special Tool T-18502 to compress the release spring far enough to expose the snap ring groove in the shaft.

   d. Install the snap ring.

MG_054

MG_053

Figure 105. Release Spring, Spring Retainer and Snap Ring Installation

4. Install the clutch plates as follows: Install a sintered (faced) clutch plate and alternate with steel and sintered plates until the ten steel and eleven sintered plates are installed, finishing with a sintered plate.

MG_052

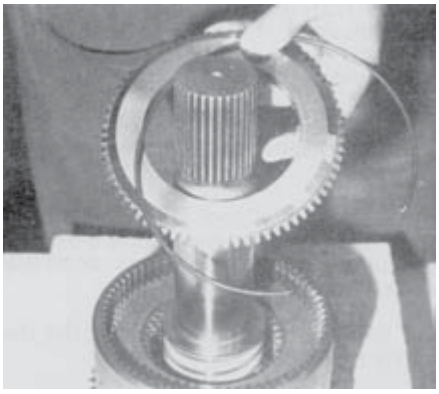
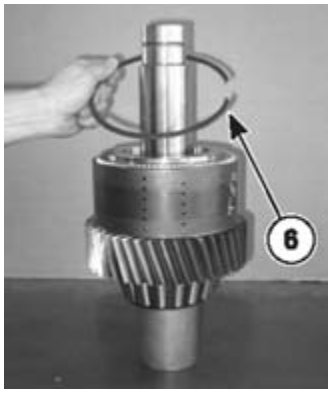

DCP_2001

Figure 106. Clutch Plates Installation

5. Install the clutch back plate (5). Press the back plate firmly into the clutch housing to ensure the splines of the clutch are aligned.

6. Place the internal snap (6) ring next to the clutch back plate.



AAR6557-069 AAR6557-1012

Figure 107. Clutch Back Plate (5) and Internal Snap Ring (6)

7. Install the front thrust bearing onto the input shaft in this order: thrust race (pilots on shaft) with recessed bore over the snap ring, needle bearing, and thrust race (pilots in bore of pinion).

DCP_1048

Figure 108. Installing Front Thrust Needle Bearing and Thrust Races

8. Lubricate the area of the clutch shaft that will contact the pinion assembly. Install the pinion assembly. Gently rotate the pinion as it is lowered into the clutch plates until the splines are fully engaged in all the clutch plates.

DCP_1046

Figure 109. Pinion Assembly Installation

9. Install the larger diameter thrust race into the pinion bore.

10. Install the front needle bearing and remaining rear thrust race.

Note: This thrust race pivots on the shaft.

DCP_1045

Figure 110. Front Thrust Races and Needle Bearing Installation

11. Install the snap ring to retain the front thrust races, needle bearing and pinion.

DCP_1043

Figure 111. Snap Ring Installation

Secondary Shaft Assembly

1. If removed, install a new rear taper bearing cone on the output end of the shaft.

   a. Heat the bearing cone to 120°C (250°F).

⚠ WARNING
Handle the bearing cone with care. The bearing cone is HOT.

   b. Place the bearing cone on the clutch shaft and push it firmly into position against the clutch housing.

   Note: Be sure to seat the bearing cone against the clutch housing as the bearing cools.

2. Install the clutch piston into the clutch housing.

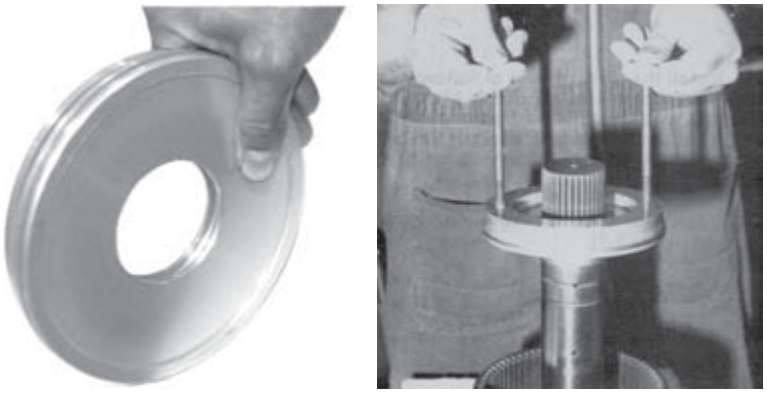
   a. Lubricate and install a new piston ring on the outside diameter of the clutch piston.

   b. Lubricate and install a new O-ring in the inside diameter of the clutch piston.

   c. Thread the two M8-1.25 mm rods into the clutch piston.

   d. Lubricate the clutch piston bore with a thin film of grease. Install the clutch piston into the clutch housing.

   Note: If the clutch piston is difficult to install by hand, remove the clutch piston and inspect the piston rings.



MG_306 DCP_2000

Figure 112. Piston Ring, O-ring and Clutch Piston Installation

3. Position the secondary clutch shaft under a hydraulic press.

   a. Slide the release spring over the shaft.

   b. Place the spring retainer on the release spring.

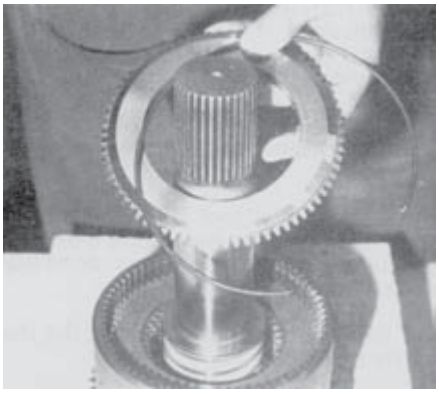
   c. Use Special Tool T-18502 to compress the release spring far enough to expose the snap ring groove in the shaft.

   d. Install the snap ring.

MG_054 MG_053

Figure 113. Release Spring, Spring Retainer and Snap Ring Installation

4. Install the clutch plates as follows: Install a sintered (faced) clutch plate and alternate with steel and sintered plates until the ten steel and eleven sintered plates are installed, finishing with a sintered plate.

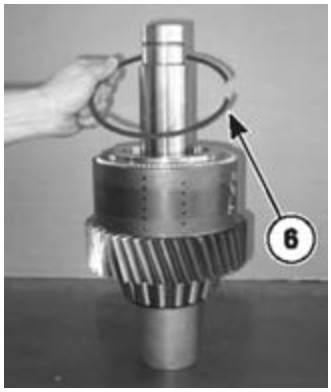


MG_052 DCP_2001

Figure 114. Clutch Plates Installation

5. Install the clutch back plate (5). Press the back plate firmly into the clutch housing to ensure the splines of the clutch are aligned.

6. Place the internal snap (6) ring next to the clutch back plate.



AAR6557-069 AAR6557-1012

Figure 115. Clutch Back Plate (5) and Internal Snap Ring (6)

7. Install the front thrust bearing onto the input shaft in this order: thrust race (with recessed bore over the snap ring), needle bearing, and thrust race.

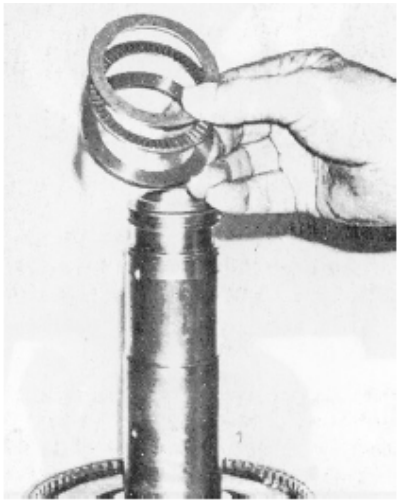


Figure 116. Installing Front Thrust Needle Bearing and Thrust Races

8. Lubricate the area of the clutch shaft that will contact the pinion assembly. Install the pinion assembly. Gently rotate the pinion as it is lowered into the clutch plates until the splines are fully engaged in all the clutch plates.

DCP_1045

Figure 117. Pinion Assembly Installation

9. Install the larger diameter thrust race into the pinion bore.

10. Install the front needle bearing and remaining rear thrust race.

    Note: This thrust race pivots on the shaft.

DCP_1043

Figure 118. Front Thrust Races and Needle Bearing Installation

11. Install the snap ring to retain the front thrust races and needle bearing and pinion.

Main Housing Assembly

1. If removed, install new clutch shaft input end outer bearing cups in the main housing.

    a. Deep freeze the bearing cup to -51°C (-60°F) for at least two hours before installing it.

⚠ WARNING
Handle the bearing cup with care. The bearing cup is extremely COLD.

    b. Lubricate the bearing bore in the main housing.

    c. Install the bearing cup into the main housing. Be sure the bearing cup is bottomed in the bore as the bearing cup warms to the ambient temperature.

2. If removed, install a new output shaft bearing cup in the main housing.

    a. Deep freeze the bearing cup to -51°C (-60°F) for at least two hours before installing it.

⚠ WARNING
Handle the bearing cup with care. The bearing cup is extremely COLD.

    b. Lubricate the bearing bore in the main housing.

    c. Install the bearing cup into the main housing. Be sure the bearing cup is bottomed in the bore as the bearing cup warms to the ambient temperature.

3. Install a new input shaft seal.

    a. Apply MA1015 sealer to the outside diameter of a new input shaft seal.

    b. Press the seal into the housing using Special Tool TD-300492. Lip of seal should face away from the main housing when installed and rear of seal should be flush with the rear of the front housing bore.

Output Gear and Output Shaft Assembly

Note: Position the main housing with the input end down. Be sure the main housing is securely supported.

1. Clean and inspect the output gear tapered bore.

   a. Prepare the gear tapered bore surface for assembly by using a Scotchbrite® pad to remove any burrs.

   b. Clean the shaft tapered sruface and the gear bore with an appropriate solvent. Dry the shaft and clear all oil passages in the shaft with compressed air.

⚠ CAUTION

If the gear or shaft is damaged and cannot be repaired wihtout material removal, replace the part.

⚠ CAUTION

The tapered surface of the shaft and matching tapered gear bore must be completely free of grease, oil dirt and solvent residue. Failure to properly clean mating parts could prevent proper advance of the gear on the shaft and adversely affect torque carrying capacity of the assembled joint.

2. Place Special Tool T-300494 on a press. Place the main housing on the tool. The housing can be blocked in place in the absense of the special tool.

MG_306

Figure 119. Main Housing Placed on spacers or (Special Tool T-300494)

3. Place the output gear into the main housing and position it on the mounting hub of the tool or an appropriate spacer ring.

4. Use a hoist to carefully place the output shaft into the bore of the gear and into the tool.

5. Measure from the end of the output shaft to the face of the output gear. Measure three locations around the shaft. The three readings should be identical. Record this distance as Dimension A (reference drawing).

Dimension A = _____

6. Press the output shaft into the output gear up to the shoulder of the shaft. A static press force of 543 to 760 kN (62 to 85 tonf) will be required to press the shaft in place.

7. Again measure from the end of the output shaft to the face of the output gear. Measure three locations around the shaft. The three readings should be identical. Record this distance as Dimension B (reference drawing).

Dimension B = _____

8. Determine the actual gear advance. Subtract Dimension A from Dimension B. The actual gear advance should be between 3.81 to 5.33 mm (0.15 to 0.21 in.).

⚠ CAUTION

If the calculated advance falls outside the range given in the table, check to ensure all measurements / calculations are correct. If no errors are found, it will be necessary to change parts. Contact the Product Service Department of Twin Disc, Incorporated.

9. Place the output gear pan in position around the output gear.

DCP_1034

Figure 120. Position Output Gear Pan

10. Install the output bearing cones onto the output shaft.

    a. Heat both output shaft rear bearing cones to 120°C (250°F) for 30 minutes.

⚠ CAUTION

Handle the bearing cones with care. The bearing cones are HOT.

    b. Lubricate the output shaft.

    c. Place the cones onto the output shaft back-to-back. Install the larger diameter cone onto the shaft.

    d. Use Special Tool TD-300496 to install the smaller diameter cup against the first one with the cage facing the rear of the housing.

DCP_1040

Figure 121. Output Bearing Cones Installation (for example only)

Output Shaft Seal Carrier

1. If removed, install a new bearing cup in the seal carrier.

    a. Deep freeze the bearing cup to -51°C (-60°F) for at least two hours before installing it.

⚠ WARNING
Handle the bearing cup with care. The bearing cup is extremely COLD.

    b. Lubricate the bore of the seal carrier.

    c. Install the bearing cup using Special Tool TD-300496.

2. Install a new output shaft seal in the seal carrier.

    a. Apply MA1015 sealer to the outside diameter of a new output shaft seal.

    b. Install the seal into the carrier using Special Tool TD-300494. Lip of seal should face away from the seal carrier when installed. Install the seal until it bottoms in the bore.

3. Install a new O-ring in the pilot diameter groove.

    a. Coat the O-ring with grease.

    b. Install the O-ring in the groove.

5. Install the output shaft seal carrier to the main housing.

    a. Place the shims and seal carrier on the main housing

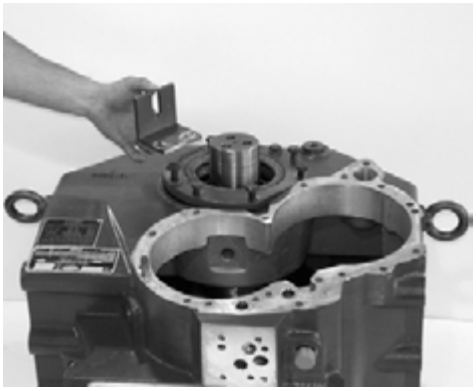
    b. Secure the seal carrier. Torque the M12-1.25 capscrews to 80 N•m (59 lb•ft).

c. Verify the bearing endplay remains within its tolerance. Adjust bearing end play to proper setting of 0 to 0.05 mm (0 to 0.002 in.).

DCP_1039 DCP_1038

Figure 122. Output Shaft Seal Carrier Installation

6. Install the output speed sensor pickup bracket.



DCP_1037

Figure 123. Output Speed Sensor Pickup Bracket Installation

Output Flange

1. Lift the output shaft and the main housing. Place a spacer thick enough under the front end of the output shaft to allow clearance between the special tools. The clearace should allow the press load to act only on the output shaft and output flange.

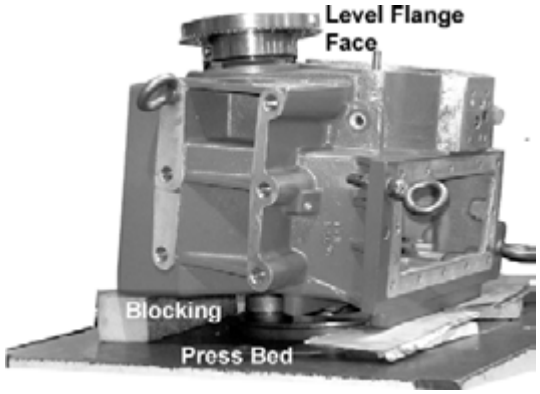
2. Install the output flange.

   a. Place the output flange on the output shaft. Be sure that the flange face is parallel with the ram face. (Use a level on the flange face while blocking the housing to insure proper alignment.)

   b. Press the output flange onto the shaft. A static force of 595 to 743 kN (66.9 to 83.5 tonf) is required. The actual advance of the output flange should be between 6.0 to 7.62 mm (0.236 to 0.300 in.).

   c. Secure the clamp plate to the output flange. Torque the M16-2x50 mm screws to 192 N•m (141 lb•ft).

   d. Remove the main housing from the press and special tool.



MG_308

Figure 124. Output Flange Installation

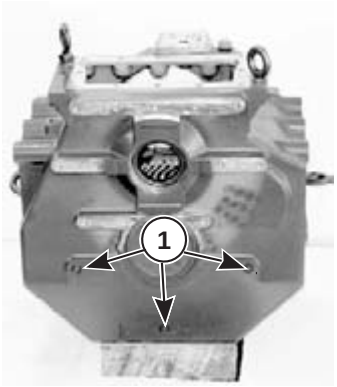
Install Internal Parts

Output Gear Pan

Note: Place the main housing in the upright position. Be sure the main housing is securely supported.

1. Place new seal washers on the three M18 output gear pan capscrews (1). The bottom capscrew is shorter.

2. Torque the capscrews to 23 N•m (18 lb•ft).



DCP_1031

Figure 125. Securing Output Gear Pan

Output Shaft Front Bearing Carrier

1. Heat the bearing inner race to 120°C (250°F) for 30 minutes before installing it. Install the bearing inner race on the output shaft.

⚠ CAUTION

Handle the bearing with care. The bearing is HOT.

2. Deep freeze bearing outer race and rollers to -51°C (-60°F) for at least two hours.

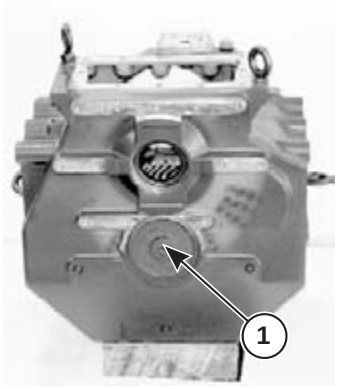
⚠ WARNING

Handle the bearing outer race with care. The bearing outer race is extremely COLD.

3. Lubricate the bore of the main housing. Install the outer race and rollers into the main housing.

Front Output Cover

1. Lubricate a new O-ring with grease.
2. Install the O-ring onto the cover.
3. Press the cover (1) into bore of the main housing.



DCP_1031_1

Figure 126. Front Output Cover (1) Installation

Input Housing

1. Position the input housing on the main housing.
2. Secure the input housing with twelve M12-1.75 capscrews and washers. Torque the capscrews to 80 N•m (59 lb•ft).

DCP_1030 DCP_1029

Figure 127. Input Housing Installation

Front Bearing Carriers

Note: Position the main housing with input end down. Be sure the main housing is securely supported.

1. If necessary, assemble the primary clutch shaft and secondary cltuch shaft front bearing carriers.

   a. Heat a bearing cone to 120°C (-60°F) for 30 minutes before installing it.

⚠ CAUTION

Hand the bearing cone with care. The bearing cone is HOT.

   b. Deep freeze the sleeve (or bushing) to -51°C (-60°F) for at least two hours.

⚠ WARNING

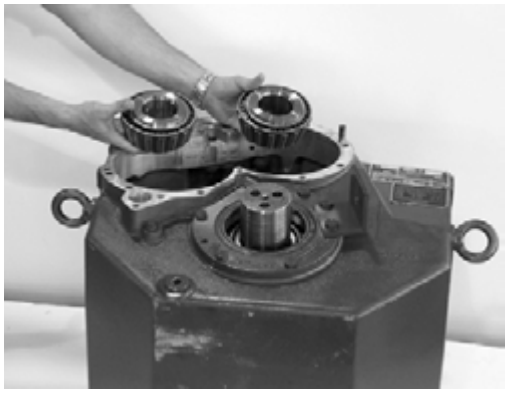
Handle the sleeve with care. The sleeve is extremely COLD.

   c. Lubricate the sleeve.

   d. Press the sleeve into the cup and cone.

2. Lubricate and install the primary clutch shaft front bearing and carrier assembly.

3. Lubricate and install the secondary clutch shaft front bearing and carrier assembly.



DCP_1028

Figure 128. Primary and Secondary Front Bearing Carriers Installation

Install Secondary Clutch Shaft

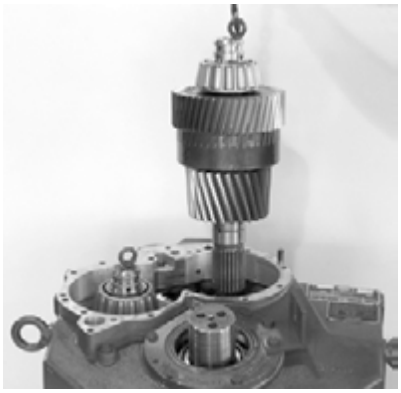
1. Install a lifter eye into the end of the secondary clutch shaft.
2. Lubricate the input end of the shaft.
3. Use a hoist to install the secondary clutch shaft in the main housing.

DCP_1027

Figure 129. Secondary Clutch Shaft Installation

Install Primary Clutch Shaft

1. Install an eyebolt into the output end of the primary clutch shaft.
2. Lubricate the input end of the shaft.
3. Use a hoist to install the primary clutch shaft in the main housing.



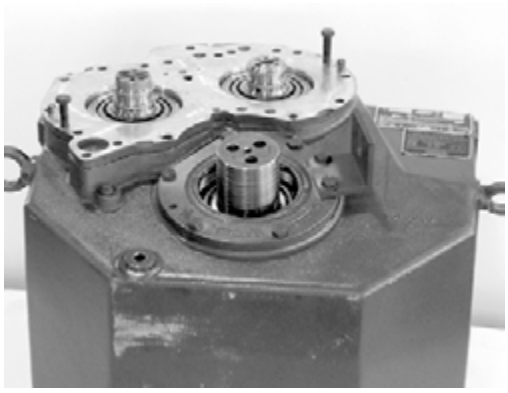
DCP_1026

Figure 130. Primary Clutch Shaft Installation

Primary and Secondary Rear Bearing Adjustment

1. Install new bearing cups into the bearing carrier.
2. Using a new gasket, place the rear bearing carrier on the main housing.
3. Install the bearing spacers and excess shim pack.

DCP_1023


DCP_1022

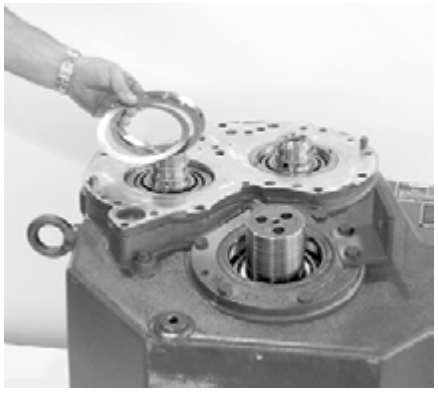

DCP_1020

Figure 131. Rear Bearing Carrier and Spacers Installation

3. Install the manifold using a new gasket. Torque the M10-1.5x45 mm manifold capscrews to 46 N•m (34 lb•ft).
4. Install eyebolts to the end of the primary and secondary clutch shafts.
5. Using a dial indicator and two levers, lift the shafts. Record the endplay measurement for each shaft.

6. Calculate the shim pack thickness. The correct shim pack thickness require a preload of 0.0 to 0.07 mm (0.0 to 0.003 in.), i.e., a normal preload of 0.035 mm (0.0014 in.).

Example:

Endplay measurement	= 1.27 mm (0.05 in.)
Required shim pack thickness	= 1.27 mm + 0.035 mm = 1.305 mm (0.05 in. + 0.0014 in. = 0.0514 in.)

7. Remove the manifold. Be sure to reuse the same gaskets on assembly that were used to determine the required shim pack.

8. Install required shims, aligning hole with roll pin in spacer.

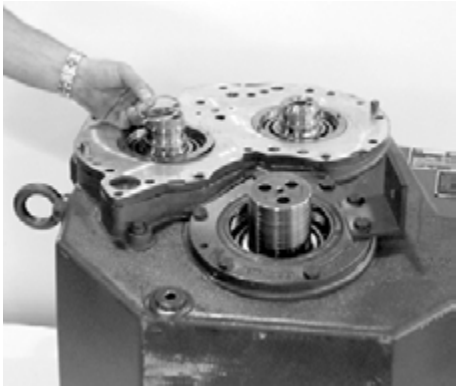
Oil Lubrication Tube

1. Install the tube into the rear bearing carrier.

2. Be sure the tube is aligned with slot.

Piston Rings

Install the piston rings in the grooves at the end of the primary and secondary clutch shafts.



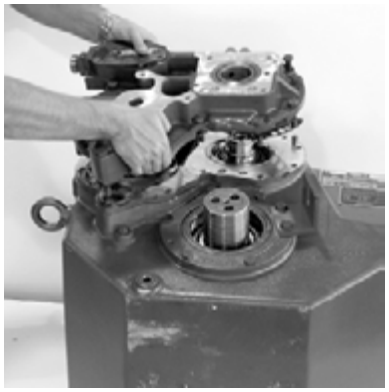
DCP_1019

Figure 132. Piston Ring Installation

Manifold

1. Place the manifold gasket on the rear bearing carrier.

2. Position the manifold on its gasket. Align roll pin and shim pack with clearance cavity in manifold. Torque the capscrews to 46 N•m (34 lb•ft).



DCP_1017 DCP_1014

Figure 133. Manfold Installation

Hydraulic Oil Filter

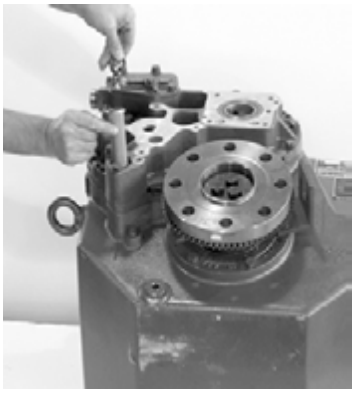
Install filter bypass valve cover and install a new hydraulic oil cover.

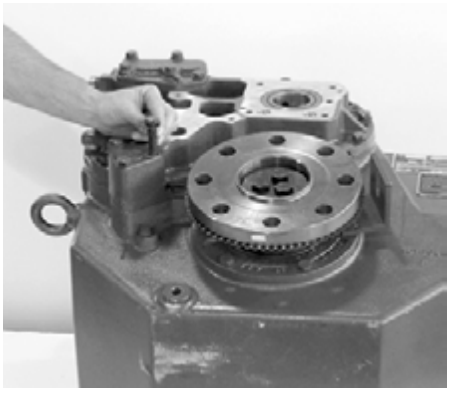
Oil Level Gauge

Install the oil level gauge to the main housing.

Suction Strainer

1. Place the suction strainer in the manifold.
2. Secure the suction strainer with the clamp plate and capscrew.
3. Torque the M12 capscrew to 80 N•m (59 lb•ft).





DCP_1008 DCP_1007

Figure 134. Suction Strainer Installation

Install External Parts

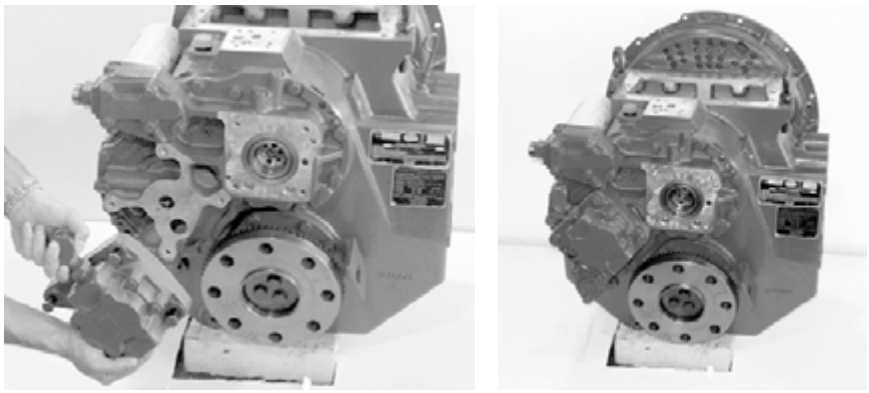
Hydraulic Pump

1. Verify that the pump drive tang engeages correctly in the slot at the end of the secondary clutch shaft.

2. Observe the index marks on the pump and the manifold made during disassembly. Install the pump following the index marks.

   Note: Verify that the pump is installed in the correct position. The position can vary following the engine direction of rotation. If necessary, refer to the Engineering Drawings at the end of this manual.

3. Torque the four M10-1.5 capscrews to 46 N•m (34 lb•ft).



DCP_1006 DCP_1004

Figure 135. Hydraulic Pump Installation

PTO Cover and Top Cover

1. Apply MA1015 sealer to the sealing surface of the PTO cover (1).

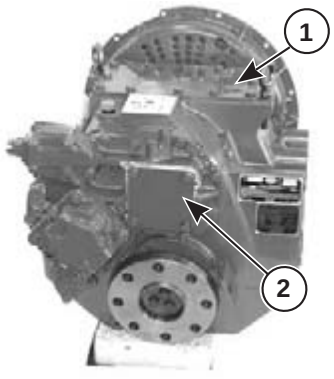
2. Install the PTO cover.

3. Torque the four M12-1.75 capscrews to 80 N•m (59 lb•ft).

4. Place a new gasket on the sealing surface of the top cover.

5. Install the top cover (2).

6. Torque the twelve M12 x 30 capscrews to 80 N•m (59 lb•ft).



DCP_1001

Figure 136. PTO Cover (1) and Top Cover (2) Installation

Input Coupling

1. Apply molydisulfide grease to the splines at the input end of the primary shaft. Lubricate the lips of the input oil seal.

2. Position the input hub on the shaft.

3. Temporarily attach the coupling to the input housing for shipping.

Control Valve

Mechanical Control Valve (PX-9975). Install valve onto the transmission and torque the attaching screws to 20 N•m (27 lb•ft).

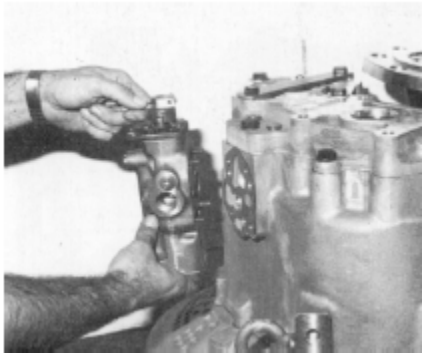


Figure 137. Installing Selector Valve Assembly

Electronic Control Valve (PX-10225). Install gasket and valve onto the transmission and torque the attaching screws to 20 N•m (27 lb•ft). Install the solenoid coils onto the spools and torque the retaining nuts to 6.8 N•m (5 lb•ft)

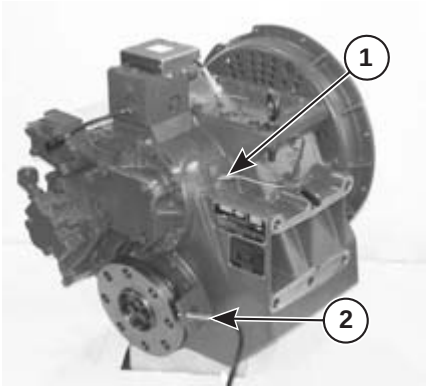
Figure 138. Solenoid Components

Heat Exchanger

1. Install the support bracket to the main housing.
2. Place the heat exchanger in its support bracket.
3. Connect the oil-out hose to the fitting on the main housing.
4. Connect the oil-in hose to the fitting on the oil pump housing.

Speed Sensors

1. Apply MA908 (Locktite® 242) to the threads of the output sensor (2).
2. Assemble the output speed sensor until it contacts tip of a gear tooth.
3. Back out the output sensor two full turns.
4. Secure the output sensor in place with two jam nuts.
5. Apply MA908 (Locktite® 242) to the threads of the input sensor (1).
6. Assemble the input speed sensor until it contacts tip of a gear tooth.
7. Back out the input sensor one full turn.
8. Secure the input sensor in place with two jam nuts.

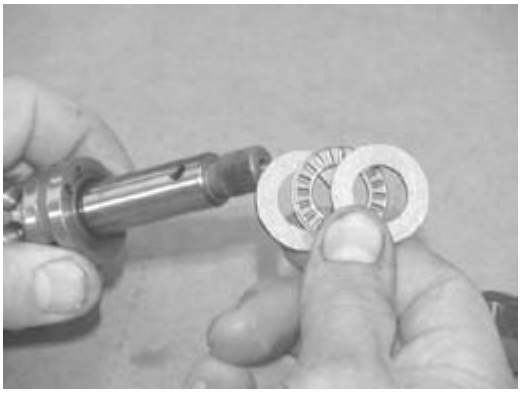


DCP_1000

Figure 139. Input Speed Sensor (1) and Output Speed Sensor (2) Installation

Mechanical Control Valve Assembly (PX-9975)

1. Install the thrust race, thrust bearing, and second thrust race onto the stem.



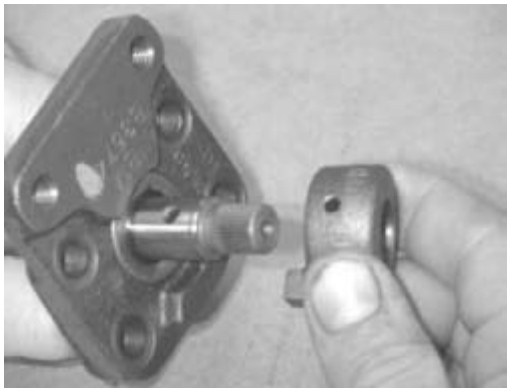
MG_235

Figure 140. Installing Thrust Bearing and Races

2. Install a new oil seal and O-ring into the valve cover.

3. Apply grease or oil to the shaft of the valve stem, oil seal, and O-ring. Install the stem into the valve cover.

4. Install the stop collar onto the stem so that the roll pin holes are aligned as well as the marks made at disassembly. Drive the roll pin into the collar and stem while supporting the stem to prevent damage to the parts.



MG_233 MG_232

Figure 141. Installing Stop Collar (left) and Roll Pin (right)

5. Place the cover gasket over the stem assembly against the cover. Install the assembly into the valve body, and torque the attaching screws to 33 N•m (24 lb•ft).

MG_231

Figure 142. Installing Stem Assembly into Valve Body

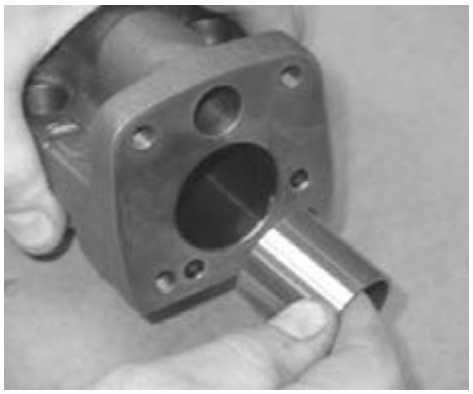
6. Install the detent ball, spring and O-ring plug. Torque the plug to 37 N•m (27 lb•ft).

MG_230

Figure 143. Installing Detent Ball, Spring, and O-ring Plug

7. Install the valve lever, aligning the marks made at disassembly. Torque the screw to 15 N•m (11 lb•ft).

8. Install the pressure regulator piston and springs into the valve body.



MG_228 MG_227

Figure 144. Installing Regulator Piston (left) and Springs (right)

9. Install the pressure regulator adjustment shims into the rate-of-rise piston.

MG_226

Figure 145. Pressure Regulator Adjustment Shims

10. Install the rate-of-rise piston (with shims) into the valve body.

11. Install the check ball spring shim(s) and spring into the valve body.

MG_225

Figure 146. Installing Check Ball Spring Shim(s) and Spring

12. Place one orifice plate gasket, the check ball, and the orifice plate onto the valve body.

MG_224

Figure 147. Installing Gasket, Check Ball, and Orifice Plate

13. Install the remaining gasket and orifice plate cover onto the valve body. Install the attaching screws and tighten them alternating and evenly to 33 N•m (24 lb•ft).

14. Install valve onto the transmission and torque the attaching screws to 20 N•m (27 lb•ft).

MG_200

Figure 148. Installing Selector Valve Assembly

15. Install the remaining O-ring plugs. Torque the M12 plugs to 16 N•m (12 lb•ft), and the M27 O-ring plug to 75 N•m (55 lb•ft).

Electric Control Valve Assembly (PX-10225)

Prior to assembly, all parts must be properly cleaned. Carefully inspect all O-rings for any damage, and replace as necessary. Lubricate all O-rings, and replace both gaskets.

1. Install the O-ring on the end of the shuttle ball seat and lubricate. Insert the shuttle ball, followed by the seat with O-ring. Place the spacers against the shuttle ball seat, and install the plug with sealing washer. Torque the plug to 152 N•m (112 lb•ft).

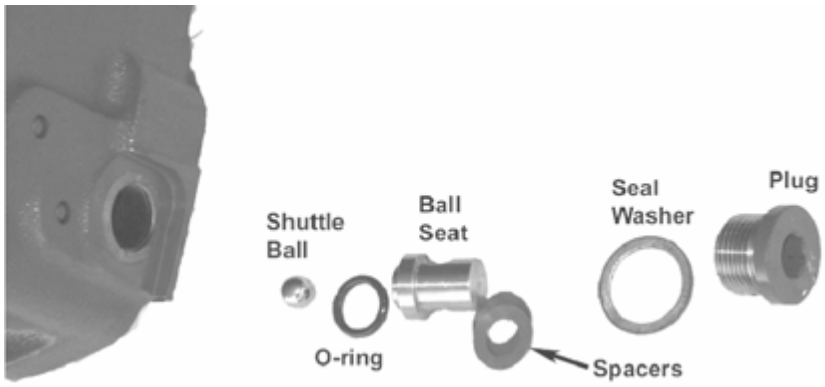


Figure 149. Shuttle Ball and Components

2. Install the rate of rise orificed plug if it was removed. Torque it to 8.5 N•m (11.5 lb•ft).

3. Install the inner cup, followed by the spring set. Insert shims (if necessary) into the rate-of-rise piston, and insert it into the bore of the valve body, and over the springs.

4. Insert the check ball spring and ball into the proper cavity, and install the gasket, ball seat plate, gasket, and end cover. Install four screws, and torque to 28 N•m (20.7 lb•ft).

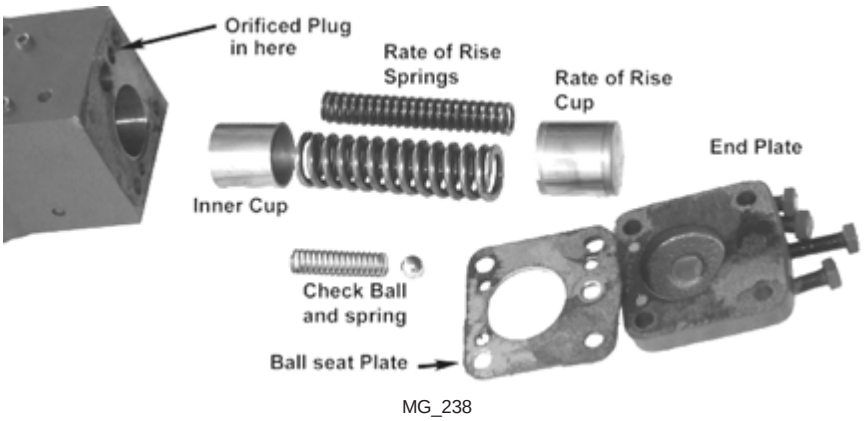
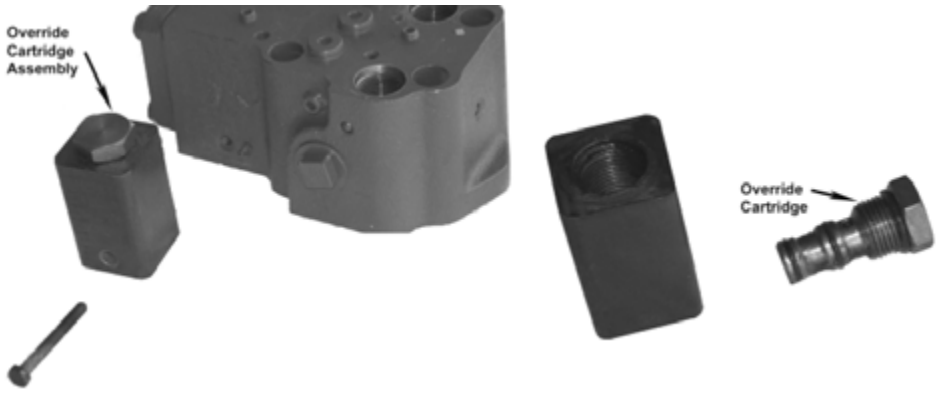


Figure 150. Rate-of-Rise Components

5. Lubricate the O-rings, and install the override cartridge into its housing if it was removed.

6. Install the override valve assembly over the rollpin, install retaining screw, and torque to 12 N•m (8.9 lb•ft).



MG_237

Figure 151. Override Valve Cartridge Assembly

7. Lubricate the O-rings, and install the solenoid spools into the bores and torque to 33.9 N•m (25 lb•ft).

8. Install gasket and valve onto the transmission and torque the attaching screws to 20 N•m (27 lb•ft).

9. Install the solenoid coils onto the spools, and torque the retaining nuts to 6.8 N•m (5 lb•ft).

MG_236

Figure 152. Solenoid Components

Assembly of GP Control Valve with Electronic Interface

Prior to assembly, all parts must be properly cleaned. Carefully inspect all O-rings for any damage, and replace as necessary. Lubricate all O-rings, and replace both gaskets.

1. **Valve Assembly 1020729**: Assemble the main regulator valve body.

    a. Install the Main Pressure pilot relief valve into the valve body and torque to 27•Nm (20 lb•ft).

    b. Install the Main Valve into the valve body and torque to 33 N•m (24 lb•ft).

    c. Install the 3/8 nptf pipe plug or optional temperature sensor into the valve body and torque to 23 N•m (17 lb•ft).

    d. Install the M27x2.0 O-ring plug into the valve body and torque to 75 N•m (55 lb•ft).

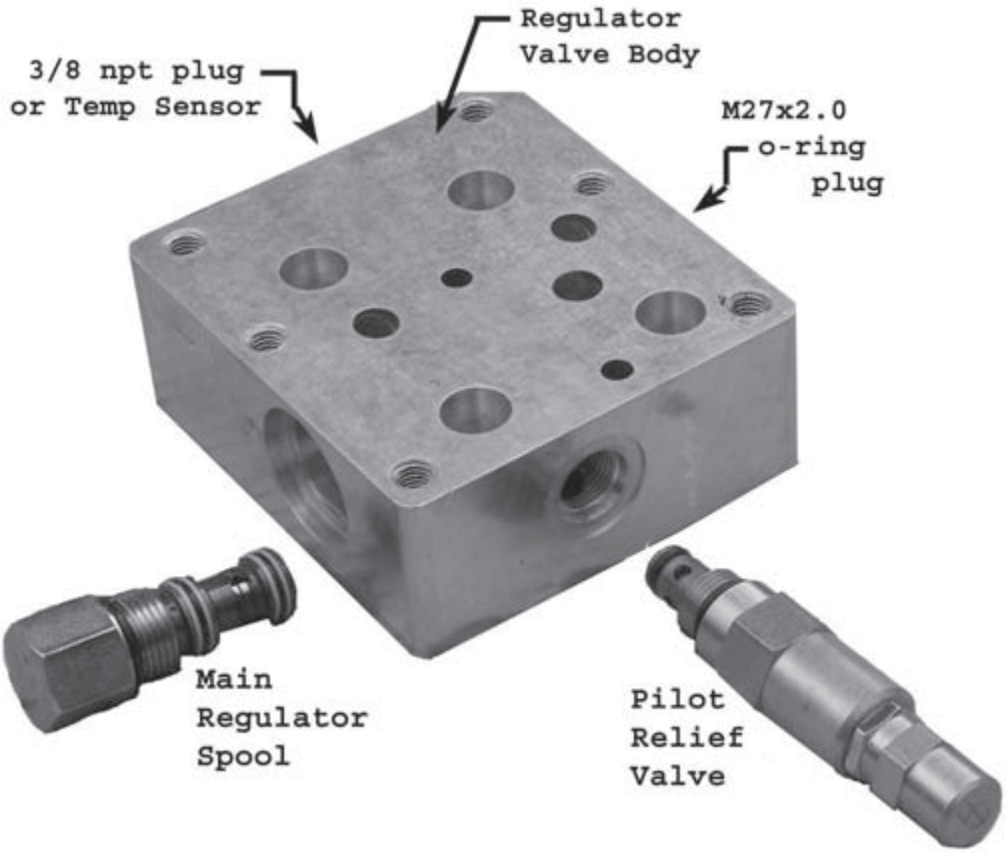


Figure 153. Main Pressure Regulator Components Assembly 1020729

1. **Valve Assembly 1021658**: Assemble the main regulator valve body.

    a. Install the filter into the threaded hole of the valve body, and torque to 7.5 N•m (5.5 lb•ft). If removed, install a new check valve assembly into the bore of the valve body, and drive it with a drift until it is flush with the face of the body. Install the 3/8 nptf pipe plug or optional temperature sensor into the valve body and torque to 23 N•m (17 lb•ft).

    b. Install the gasket and cover without the adjustment screw to the valve body with four M8 x 20 capscrews and torque to 23 N•m (17 lb•ft).

    c. Install the spool with washer, and spring into the bore. Install the gasket, and cover with the adjustment screw, using four M8 x 25 capscrews. Evenly tighten the capscrews, and torque to 23 N•m (17 lb•ft).

    d. Install the cap onto the adjusting screw finger tight as the main pressure must be set at the time of installation or testing.

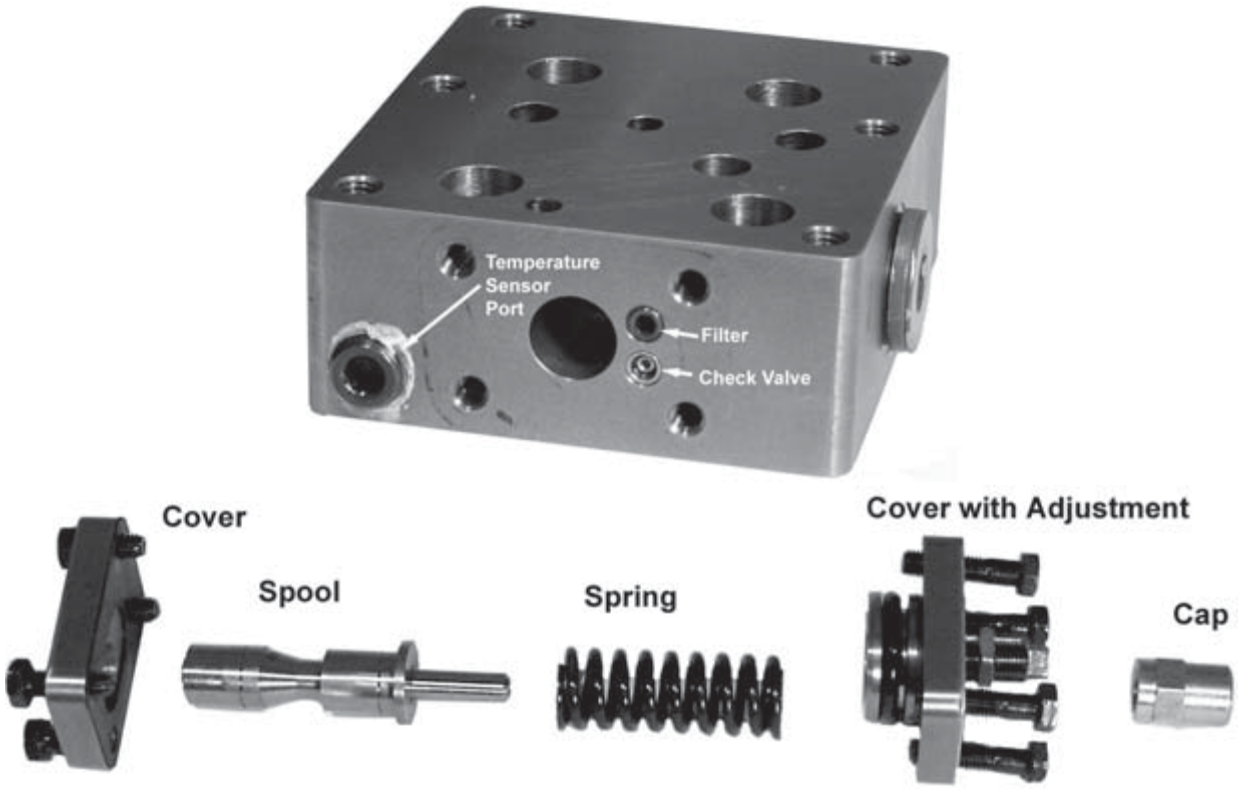


Figure 154. Assemble Main Pressure Regulator Components

2. Assemble the top valve body. Install the two proportional valve assemblies into the valve body, install the retaining plate, and torque the M6-1.00 x 16 socket head capscrew to 9.5 N•m (7 lb•ft). Install the manual direction control valve into the valve body, and torque to 27 N•m (20 lb•ft). Install the M12x1.50 O-ring plug into the valve body and torque to 16 N•m (12 lb•ft). Connect the wires for the Neutral switch.

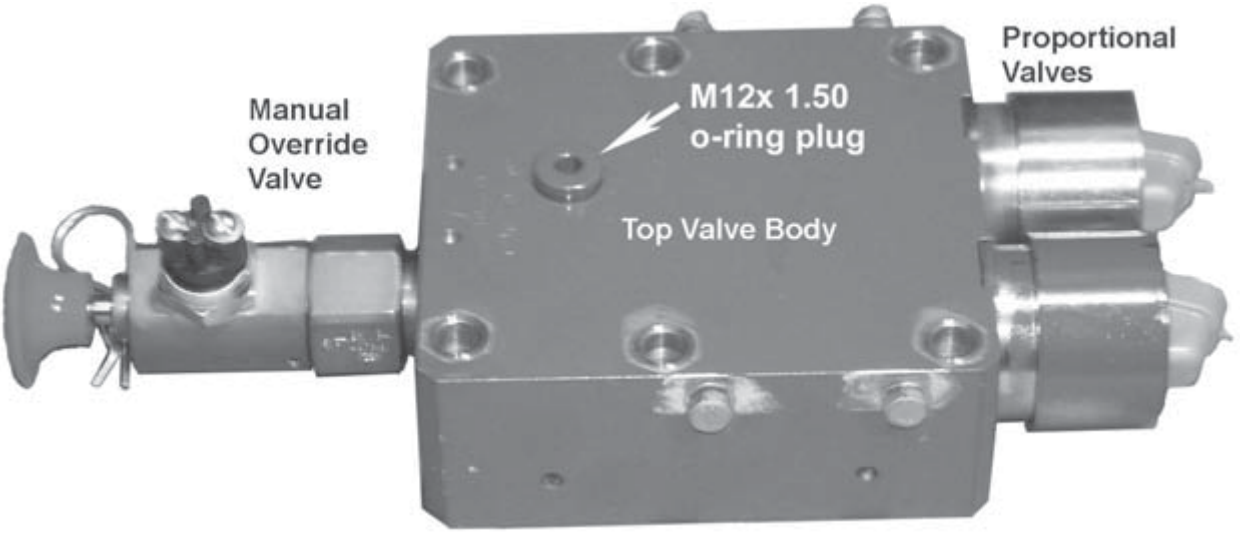


Figure 155. Assemble Top Valve Body Components

3. Install a new gasket, and the main regulator valve assembly to the transmission or ditch plate, using the four twelve point capscrews. Torque the capscrews to the level specified for the appropriate sized capscrew into aluminum threads. See the torque specifications in Description and Specifications.

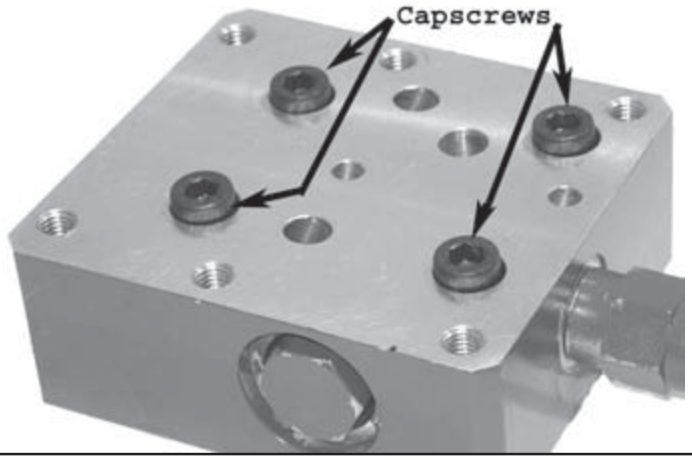


Figure 156. Install Regulator Valve Body to Transmission

4. Install a new gasket, and the top valve body assembly on the main regulator valve assembly, using six M10-1.50 x 70 hex head capscrews, and torque to 46 N•m (34 lb•ft).

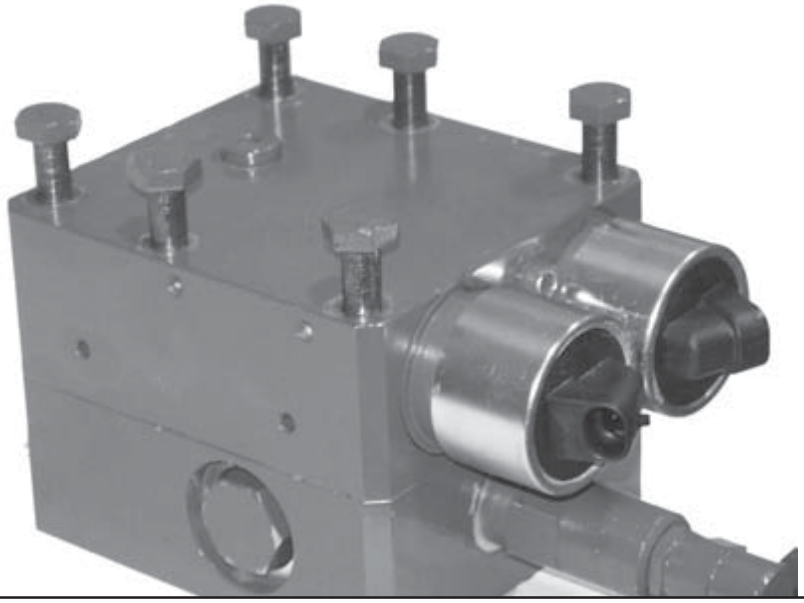


Figure 157. Install Top Valve Body onto Regulator Valve Assembly

5. Install the Electronic Profile or E-Troll Module on the top valve body, and torque the four M6-1.0 capscrews to 9.5 N•m (7 lb•ft).

Figure 158. Place Profile or E-Troll Module onto Valve and tighten screws

6. Connect the electrical wires to the proportional valves, and connect any other wires that were removed during disassembly.

Adjustment of Main Pressure

Valve Assembly 1020729: It is recommended that following the servicing of the GP valve assembly off of the transmission that a procedure be followed to ensure the flushing of oil through the valve assembly, followed by adjustment of the main pressure.

1. Install a main pressure gauge into the port on top of the top valve body.

2. Remove protective cover cap located at the end of the cartridge. This will expose a 1/4" hex head adjustment stem. Loosen the jam nut on the stem.

Figure 159. Pilot Relief Valve Assembly

3. Turn this adjustment stem counterclockwise until it reaches a positive stop. This allows the engine/transmission to be started and flush any debris past the relief valve.

   Note: This must be done with the transmission in Neutral.

4. Start engine with controls in Neutral. Main pressure should be approximately 100 psi or less. Allow the fluid to flush the valve for approximately 1 minute.

5. Turn the 1/4" hex head adjustment stem clockwise to achieve the main pressure setting. A helpful practice is to turn the adjustment stem slightly beyond the desired setting (approximately 5 psi) and then adjust for the target pressure. This aids in reducing variance in pressure setting due to torsional wind-up of the spring.

   Note: If main pressure is to be set with cold oil, adjust the main pressure approximately 5 to 10 psi higher than the desired value with hot oil.

6. Tighten the jam nut to a torque of 20 N•m (15 lb•ft), install the protective cap, and torque it to 14 N•m (10 lb•ft)

Valve Assembly 1020729:

1. Install a main pressure gauge into the port on top of the top valve body.

2. Remove protective cover cap located at the end of the adjusting stem. This will expose a slotted adjustment stem. Loosen the jam nut on the stem.

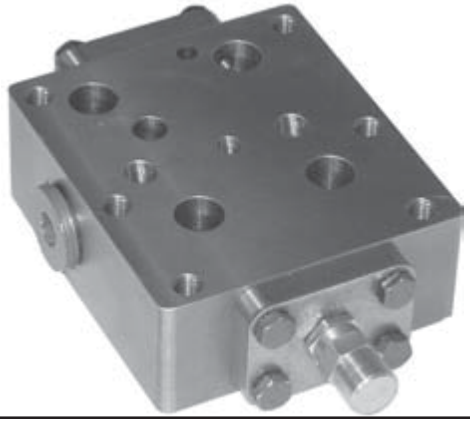


Figure 160. Main Pressure Regulating Valve Assembly 1021658

3. Start engine with controls in neutral.

   Note: This must be done with the transmission in Neutral.

4. Turn the slotted adjustment stem clockwise to achieve the main pressure setting. See the specifications in Description and Specifications.

5. Tighten the jam nut to a torque of 20 N•m (15 lb•ft), install the protective cap, and torque it to 14 N•m (10 lb•ft)

Trolling Valve Assembly (Optional Equipment)

1. Press a new oil seal into the counterbore in the end of the valve body.

2. Install the roll pin into the end of the stem (if removed).

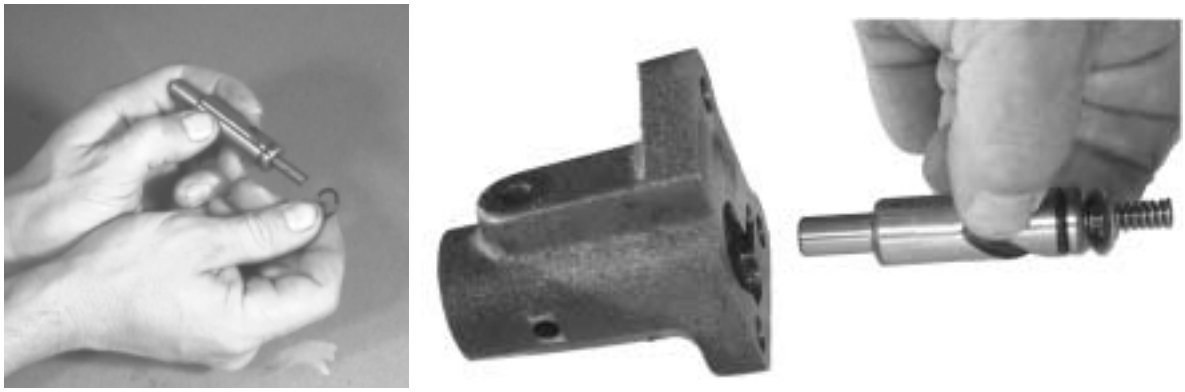
1388

Figure 161. Trolling Valve parts

3. Install the inner spring onto the roll pin in the stem end with a counterclockwise twisting motion. The spring will be installed onto the roll pin so that the first coil contacts the end of the stem.

4. Install a new O-ring into the groove of the stem.

5. Apply grease to the stem, from the O-ring to the reduced diameter end. Install the stem into the valve body, with the reduced diameter end entering the valve body first. Adjust the position of the stem if necessary to bring the helical slots into alignment with the dowel pin holes.



MG_250 1389

Figure 162. Installing O ring, and the Trolling Stem Into Trolling Valve Body

6. Install the small washer over the spring. The washer must lie flat against the end of the stem

7. Install the lever onto the stem. It may be necessary to spray the lever to be able to install it. DO NOT apply any impact force to the lever, as the stem or dog-point setscrew might get damaged.

8. Install the screw and nut to clamp the lever to the stem. Tighten the screw and nut to 9.5 N•m (7 lb•ft).

1380

Figure 163. Install the Lever onto the Stem

9. Be sure the helical slots are aligned, and press or tap the pins into the holes so that they are into the slots, but not bottomed on the slots to prevent the valve from rotating. Leave approximately 2.8 mm (0.11 in.) sticking out beyond the outside of the valve body.

1363

Figure 164. Install pins into the holes

10. Check the action of the stem in the trolling valve. If the stem does not rotate 90° smoothly, it may be necessary to drive the pins out, and reinstall them correctly.

11. Install the detent ball and spring into the remaining hole in the valve body. Apply MA908 threadlocker to the threads of the detent setscrew and install until flush with the valve body.

12. Rotate the stem to its farthest out position. Place the trolling valve lever down with the front face up. Place the outer diameter spring and piston over the small spring.

13. Place the manifold with gasket onto the trolling valve, and install the three screws, and torque them to 30 N•m (22 lb•ft)..

1391 1370

Figure 165. Installing Trolling Valve to Manifold

14. Install the gasket, and manifold with trolling valve onto the control valve. Install the attaching screws and torque them to 23 N•m (17 lb•ft).

1367

Figure 166. Install the Trolling Valve Assembly to the Control Valve using Four Screws

Installation

Prior to Installation

⚠ CAUTION

Most Twin Disc products mount directly onto the flywheel of the engine, or are attached to the flywheel through external shafting or adapters. Flywheel-to-driven component interference is possible due to mismatch of components or other reasons. Therefore, engine crankshaft endplay as well as flywheel alignment checks must be made before the driven component is installed.

After installation of the driven component, the crankshaft endplay should be measured again. The endplay at the second measurement should be the same as the first. A difference in these two endplay measurements could be an indication of interference. Consequently, the driven component should be removed and the source of interference found and corrected.

Twin Disc will not be responsible for system damage caused by engine to Twin Disc component interference regardless of the cause of interference. This engine crankshaft endplay check is considered mandatory.

The transmission housing flange and pilot, the engine flywheel and the flywheel housing must be checked for trueness. Clean the engine flywheel and flywheel housing mounting surfaces thoroughly before any measurements are made.

Note: To isolate engine vibration and prevent transferring it to the hull through the propeller shaft, the distance from the marine gear output flange to a fixed stuffing box or the first fixed bearing must be a minimum of 20 times the shaft diameter. If the distance is less than this, a flexible coupling may be necessary to isolate the engine vibration.

Alignment (also reference SAE J-1033 and J-617)

1. Bolt a thousandths increment dial indicator or gauge to the engine flywheel so that the indicator is perpendicular to the face of the engine flywheel housing, and the indicator stem is riding on the face of the flange.

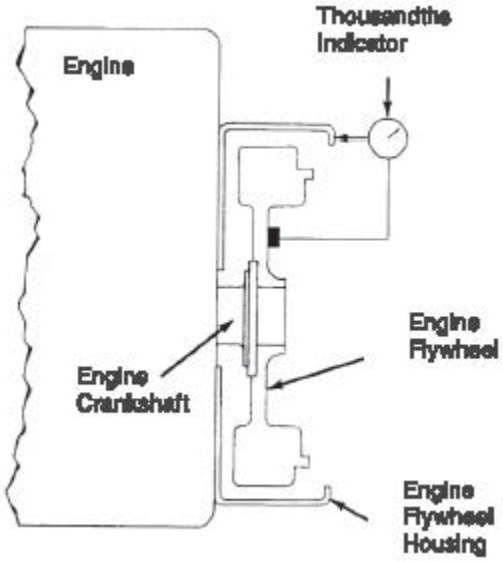


Figure 167. Checking Flywheel Housing Flange for Deviations

2. Rotate the engine flywheel, always keeping a thrust in the same direction, and note the face deviation of the engine flywheel-housing flange. The face deviation must not exceed the figures given in Table 20.

Table 20. Total Indicator Readings for Engine Flywheel Housing Flange

SAE Housing Number	Face Deviations and Bore Eccentricity mm (in)
00	0.48 (0.019)
0	0.41 (0.016)
1/2	0.36 (0.014)
1	0.30 (0.012)
2	0.28 (0.011)

3. With the indicator mounted as in the previous paragraph, adjust the indicator stem so that it will ride on the bore of the engine flywheel housing.

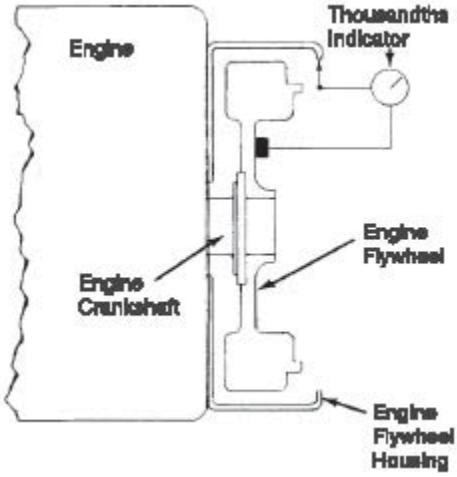


Figure 168. Checking Flywheel Housing Bore Eccentricity

4. Rotate the engine flywheel and note the bore eccentricity of the engine flywheel-housing bore. See the previous Table for allowable tolerances.

5. Bolt a thousandths dial indicator or gauge to the engine flywheel housing so that the indicator is perpendicular to the engine flywheel, and the indicator tip is riding on the inner face of the flywheel. Rotate the flywheel. The variation of the face runout of the surface to which the driving ring is bolted should not exceed 0.013 mm (0.0005 in) per inch of diameter.

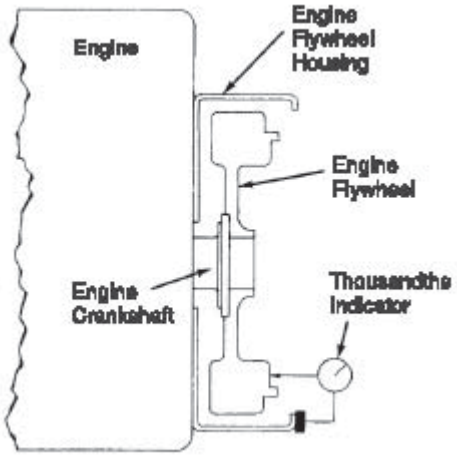


Figure 169. Checking the Flywheel Face Runout

6. With the indicator mounted as in the paragraph above, adjust the indicator tip so that it will ride on the driving ring pilot bore of the engine flywheel. Rotate the flywheel. The driving ring pilot bore eccentricity of the engine flywheel should not exceed 0.13 mm (0.005 in) maximum total indicator reading. Thrust on the flywheel should be in one direction at all times to obtain a correct reading.

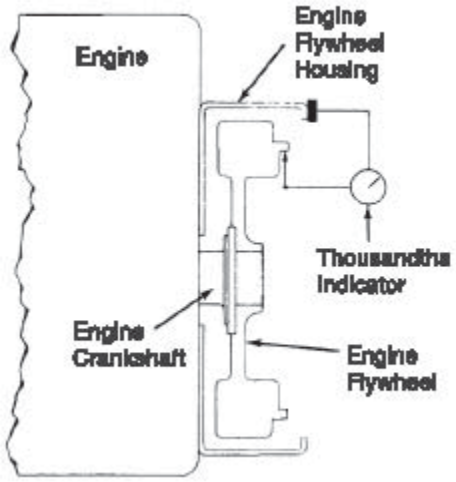


Figure 170. Checking the Flywheel Pilot Ring Bore Eccentricity

Alignment

Propeller Shaft

Before any attempt to align the engine and gearbox to the propeller shaft, proper alignment of the propeller shaft must be determined. This includes alignment of the propeller shaft through all struts and intermediate bearings. Failure to properly align the propeller shaft may result in premature wear on bearings, vibrations, or possible damage to other components.

If the length of the shaft from the last support bearing to the gearbox is excessive or a flexible stuffing box is used, the shaft must be centered prior to engine and gearbox to propeller shaft alignment.

Engine and Marine Transmission

Proper alignment of an engine and marine unit is critical, both during the initial installation and at frequent intervals during the life of the boat. It is rather common for a boat to change its form with various loads and with age. Engine and shaft alignment can also change on a boat due to varying loads and the boat's age. The following steps may be taken to secure proper marine transmission alignment.

When reinstalling a marine gear after a repair, or when installing a new marine gear to an engine already mounted in the bed rails, the flywheel housing should be checked for deflection using the following procedure:

Install the mounting brackets on the side mounting pads of the marine gear. Install the driving ring on the engine flywheel. Bolt an indicator to the engine block and set the indicator stem on the engine flywheel housing.

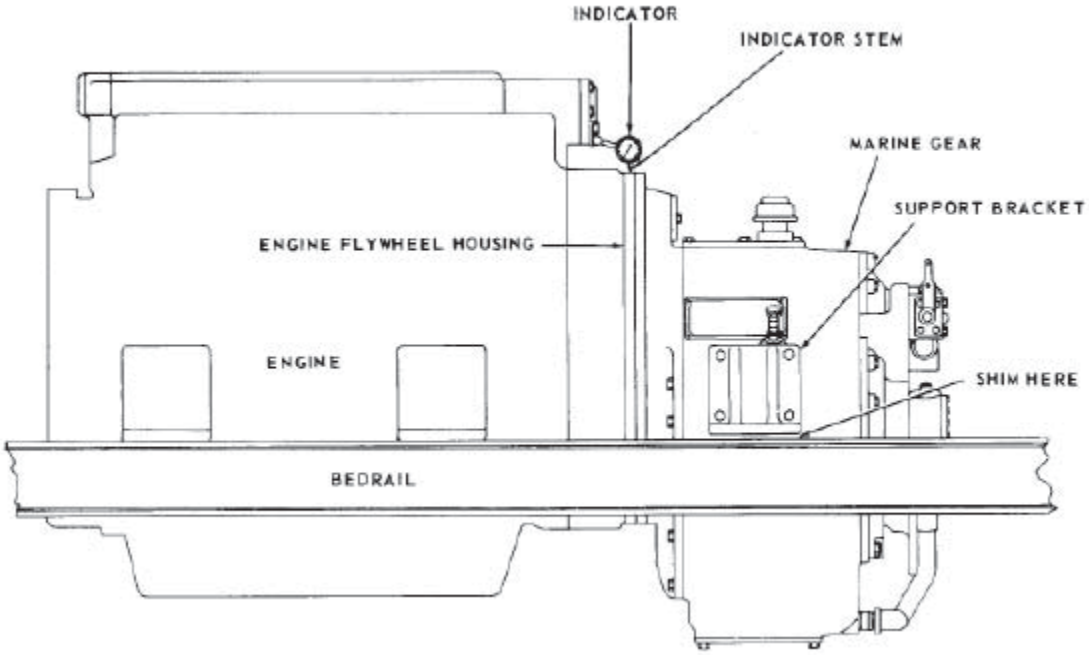


Figure 171. Marine Gear Alignment

Set the indicator gauge at zero (0). Lift the marine gear with a hoist, or other suitable means, and place the unit in position against the engine flywheel housing. Secure the flange of the marine gear main housing to the engine flywheel housing. Use a feeler gauge between each mounting bracket and engine bed rail. Add shims between the brackets and bed rails to equal the feeler gauge readings. Carefully release the lifting force on the marine gear while observing the indicator. The indicator gauge must remain steady at the zero mark. Torque the bed bolts to the proper rating. If the reading moves from zero, lift the marine gear and insert additional shims. Continue this procedure until the marine gear is completely at rest on the bed rails and the gauge maintains a steady zero reading. After obtaining the correct zero reading, indicating no distortion of the engine flywheel housing, secure the mounting brackets to the engine bed rails. Before securing the mounting brackets to the engine bed rails, the propeller shaft should be checked for alignment.

Note: The transmission output flange and companion flange bolts must be torqued to the proper value as identified in Description and Specifications.

Engine and Marine Transmission Alignment

⚠ CAUTION

When mounting the engine and transmission in the boat, all of the mounting pads on both the engine and transmission must be used. Failure to do so may result in damage to the transmission or the engine flywheel housing.

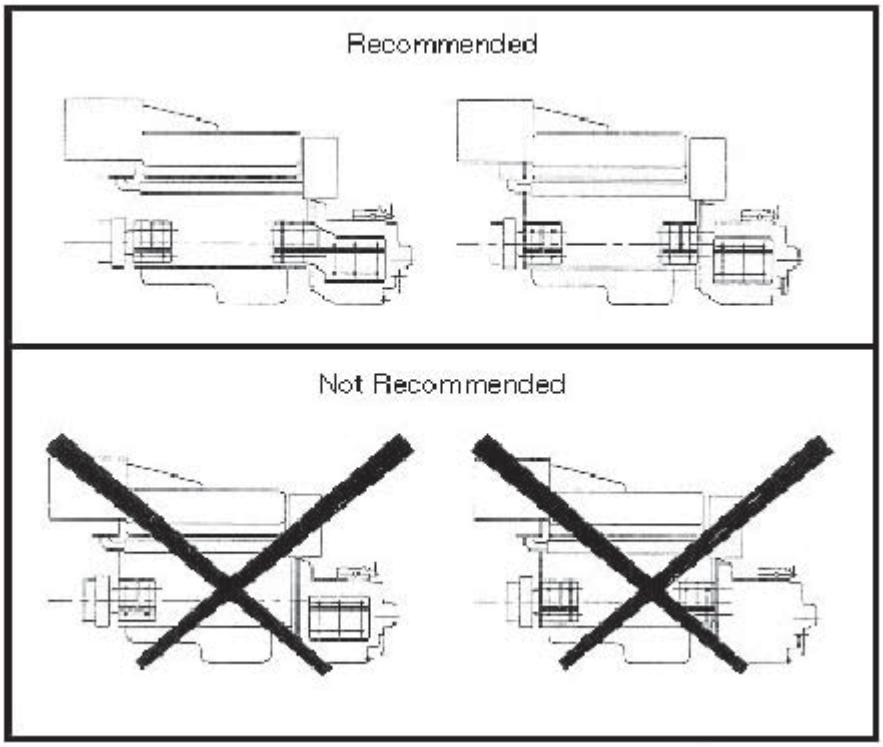


Figure 172. Transmission Mounting Configurations

When mounting the engine and transmission in the boat, all of the mounting pads on both the engine and the transmission must be used. Failure to do so may result in damage to the transmission.

It is important to align the engine and transmission only when the boat is afloat, and NOT in dry-dock. During this alignment period, it is also advisable to fill the fuel tanks and load the boat in the typical manner that it is to be used. Some boats are built with flexibility and may change shape as the loading varies.

When a heavy boat is dry-docked, it naturally undergoes some bending. Therefore, it is always good practice to unbolt the marine transmission coupling to prevent bending of the shaft.

With the engine and transmission in position on the engine bed, arrangements must be made to have a controlled lifting or lowering of each of the four corners of the engine. If threaded holes are provided in each of the engine mounts, jacking screws can be used in them. The engine can be raised by screwing down, or lowered by backing off on the jacking screws to obtain the desired adjustment.

Steel plates must be inserted under the jacking screws so that the bolts will not damage the engine bed. Lifting can also be accomplished by the use of chain hoists or properly placed jacks. Adjustable shims also are available and can simplify the alignment process, particularly for future realignment.

It may also be necessary to move the engine and transmission to one side or the other on the engine bed to obtain horizontal alignment. This can be done with a jack placed horizontally between the engine and the foundation. At the same time, a straight edge is laid across the edges of the flanges at the top and side to check the parallel alignment of the coupling edges.

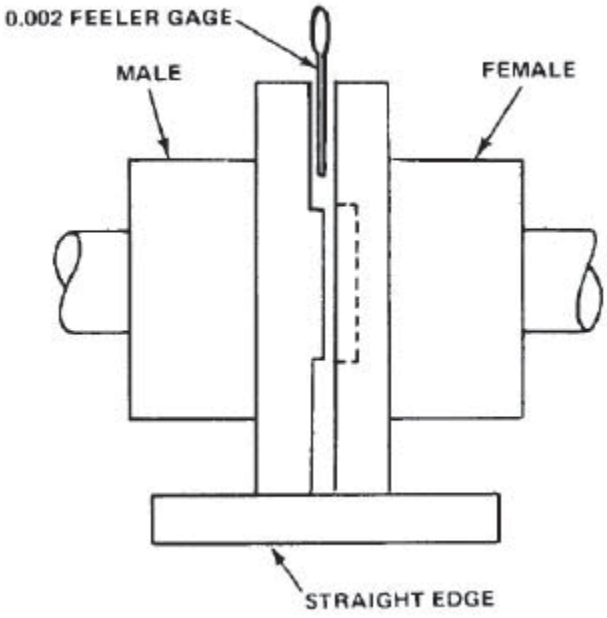


Figure 173. Checking Parallel Alignment of the Coupling

As the engine and marine transmission come into their aligned position, it will be possible to mate the output flange and propeller coupling, and prepare for bolting together. Care should be taken not to burr or mar this connection because the fit is very critical. Place a 0.05 mm (0.002 in) feeler gauge between the flanges of the coupling. Move (slide) the feeler gauge completely around the coupling. Rotate the marine transmission flange coupling in 90 degree increments, and move the feeler gauge around the flange in each successive position. The feeler gauge will fit snugly, with the same tension, all around the flange coupling in all four positions if the alignment is correct.

If the alignment varies during rotation, additional alignment is necessary, or the marine transmission and shaft couplings should be checked for proper face runout. Runout must not exceed 0.10 mm (0.004 in). Excessive face runout on the marine transmission output flange can usually be corrected by repositioning the coupling on its spline or taper. Excessive shaft coupling runout is usually due to inaccuracy of the taper fit or key to keyway interference. The optimum relative mating location will be where the measured runout dimensions of the transmission flange and the shaft coupling flange compliment each other to result in the least relative out of true parallel measurement.

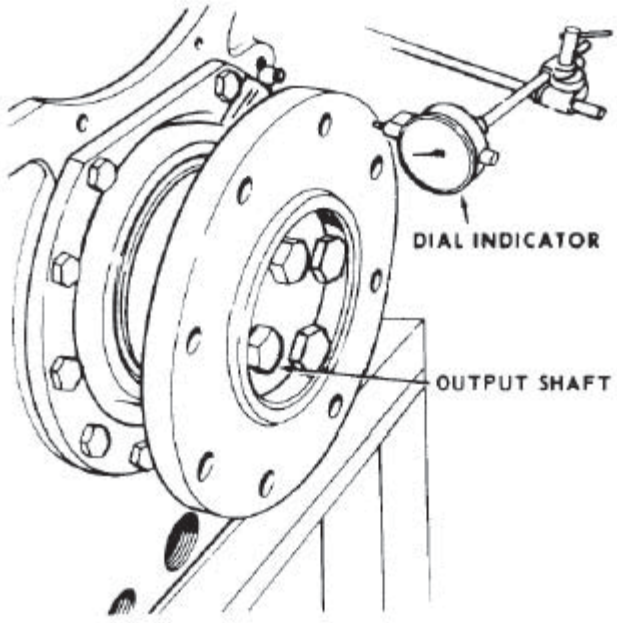


Figure 174. Checking Output Flange Face Runout

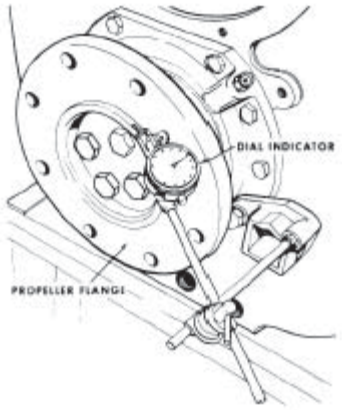


Figure 175. Checking Output Flange Pilot Eccentricity

Some boats are not structurally rigid and some carry their load in such a way that they will “hog” or go out of normal shape with every loading and unloading. Where this condition exists, it important to apply common sense alignment techniques to minimize the potential damage to any of the components.

During the process of securing final alignment, it may be necessary to shift the engine many times. When the final alignment is accomplished, mark and drill the holes for the lag studs or locating dowel pins. Then with final alignment secured, make up the necessary poured, steel, or hardwood shims, and fasten the engine and transmission in place. Then recheck the alignment, and if satisfactory, bolt the coupling together.

There are many types of flexible couplings in the market today that solve a variety of problems:

- ❑ Couplings to reduce noise and vibration.
- ❑ Couplings to allow a permanent angular misalignment.
- ❑ Couplings that allow engines to be flexibly mounted and take out the momentary misalignment.

In some cases, the proper alignment of these couplings requires an accuracy equal to that of rigid couplings. Always use the alignment procedures recommended by the coupling manufacturer.

Controls Installation

Transmission Controls

⚠ CAUTION

Transmission controls must be checked for proper function and alignment after any transmission selector valve is properly indexed in relation to the operator's control lever. Failure to do so could cause control system malfunction, resulting in personal injury and or damage to equipment and property.

See specific marine transmission installation drawings for detail and dimensional information needed for the proper installation of control linkages, power engaging devices, or electrical connections.

Mechanical Controls

Movement of the operator's selector lever to the forward, neutral or reverse position must result in the transmission control valve selector being positioned in the forward, neutral or reverse detent location. Cables and linkages must be supported properly and not have any excessive slack that will allow relative movement between the operators selector lever and the transmission control valve selector lever.

Power Controls

Selector valve positioning devices must be installed so that full travel of the actuating cylinder places the transmission selector valve in the detent position for forward or reverse, as selected, without exerting pressure on the rotational stop on the selector valve stem. Selecting neutral must place the selector valve in the neutral detent position. Improper installation of power engaging devices could cause failure of the selector valve stop permitting improper positioning of the selector valve and resulting in control malfunction.

Electrical Controls

All electrical wires and connectors must be adequately supported to prevent rubbing, chafing, or distress from relative movement. All electrical connections must be tight and free from any corrosion. It is strongly recommended that the control harnesses and wiring guidelines be followed to ensure proper installation of all wiring.

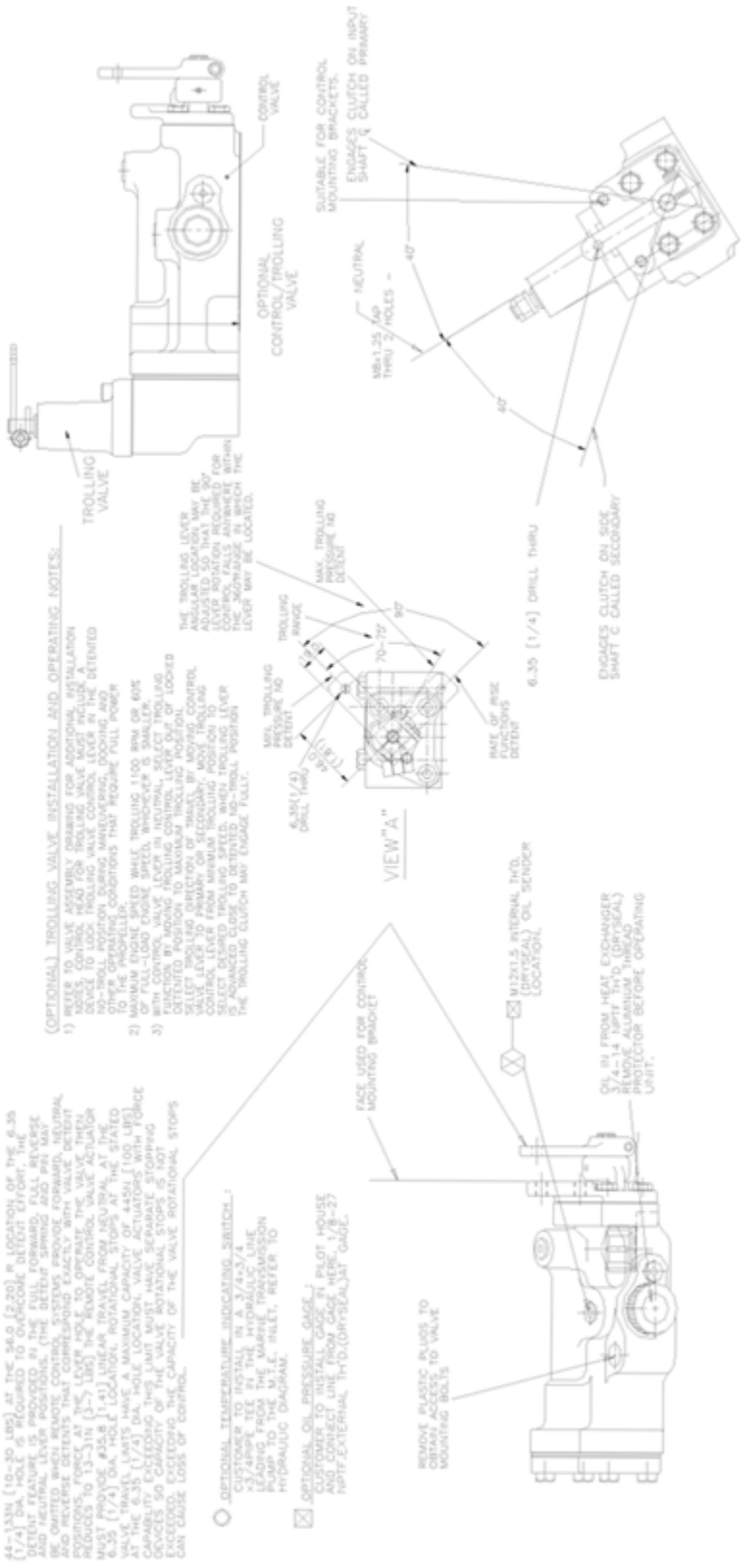


Figure 176. Mechanical Control Valve Installation Specifications

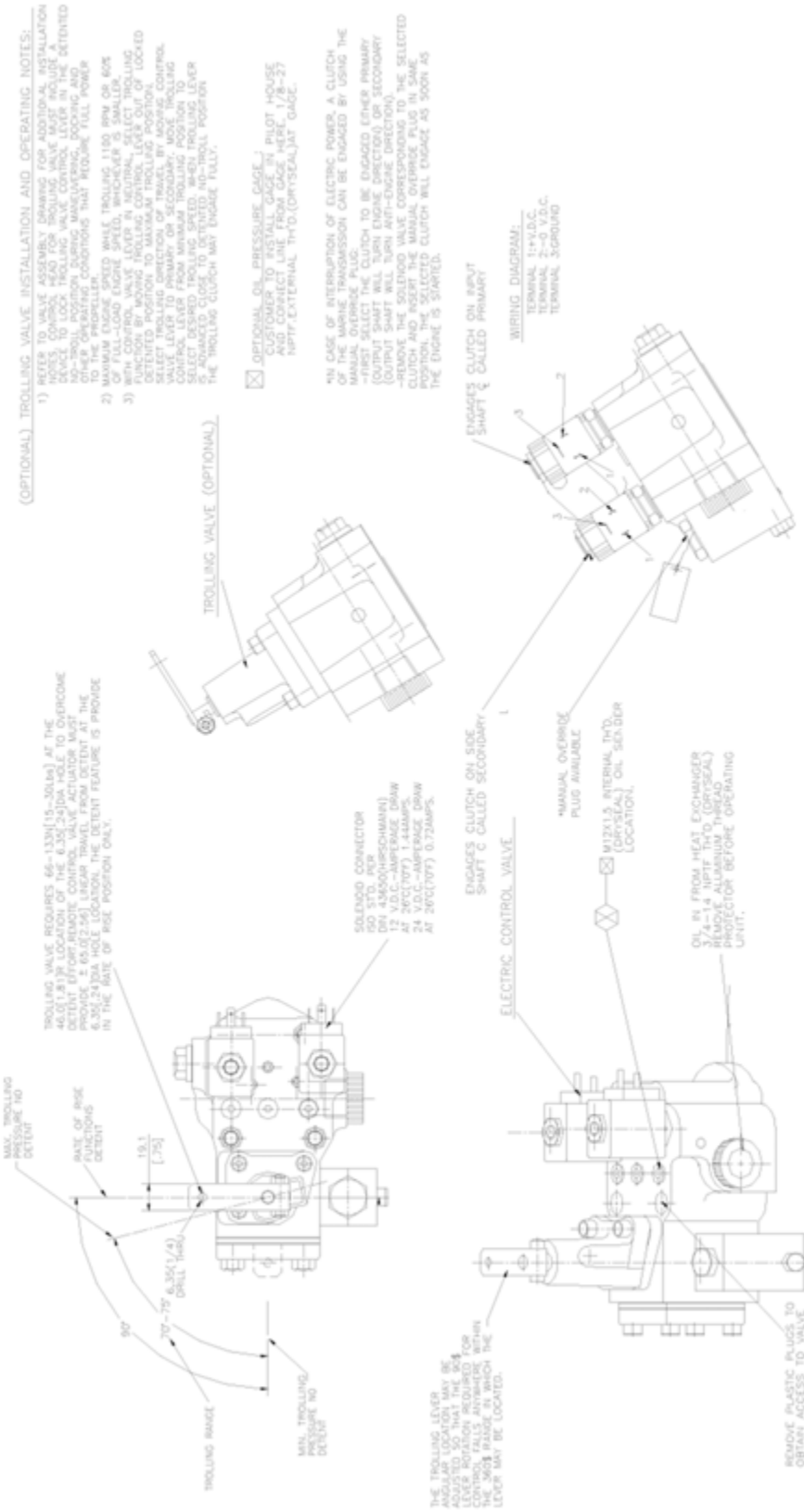


Figure 177. Electric Control Valve Installation Specifications

Control Harnesses and Wiring guidelines

Install all control wires and harnesses as follows:

1. The connector end of the control wire or harness must be secured to its own support six inches back from each connector. The wire or harness must be secured at 18 inch intervals to its own frame supports between the wire or harness ends.

2. Keep wire or harness away from hot surfaces, moving parts and oil locations.

3. Attach wire or harness to machine, making the connector the highest point of the wire. If not possible, install wire or harness with drip loop.

4. Protect wire or harness with grommet, loom or flex guard at any rub point, particularly when passing a sheet metal hole.

5. Locate wire or harness away from potential hazards. For example, a screw cutting through the jacket and shorting a conductor to the chassis, welding, drilling, etc.

6. Prevent the wire from becoming a step or hand rail.

7. When mating connectors, make sure they will mate properly. Coat pins and sockets only with dielectric compound to seal out moisture and corrosive substances (Twin Disc part number MA890 or Dow 4 Compound.) Locate and use the connector orientation key.

8. Circular connectors must be hand tightened.

9. Wire or harness bend radius must not be less than twenty times the wire or harness diameter.

10. Avoid twisting or winding the wire or harness along its axis during installation or removal.

11. Whenever mating connectors, always inspect each for damage or defects. For example: bent pins, pushed-back sockets, broken keys, etc.

12. Check that sure-seal connectors have clip/clamps in place.

13. Check the wire or harness tie downs. Keep wires securely fastened to vessel frame.

14. Check the condition of the wire or harness at any rub point and wherever the wire or harness passes through a sheet metal hole.

15. Check wire or harness for cracks, effects of vibration, abrasion, brittleness or abuse.

Wiring Connections

General

The vessel wiring for the Profile or E-Troll Module must be of sufficient size to prevent excessive voltage drop (no greater than 0.5 Vdc) between the battery connections (positive voltage and ground) and the Profile or E-Troll Module. The modules operate from nominal 12 VDC or 24 VDC batteries. The battery power connection must be protected by an electrical over-current protection component (fuse or circuit breaker) as required by the vessel's approval agency. The minimum current capacity should be 5 amps.

⚠ WARNING

DO NOT connect valve coils directly to battery power supply voltage. Use an approved Twin Disc Control System.

The customer supplied selector switches for each of the transmission clutches and for troll (if equipped) must be connected directly to the wires of the Profile or E-Troll Module, and connected to the power source as shown in the table that follows. No other electrical loads should be connected to this circuit.

Make the following Connections

The following power connection chart lists the possible configurations for connecting Electronic Profile or E-Troll Module to the power source for the three possible wiring options.

- ❑ Option 1 connections are used when the Profile or E-Troll Module is connected to non-electronic lever heads.
- ❑ Option 2 connections are used when the Profile or E-Troll Module is connected to electronic gear controllers.
- ❑ Option 3 connections are used when the Profile or E-Troll Module is connected to electronic control solenoid driver outputs. The electronic control's Solenoid A and B returns or negative signals should be connected together and connected to the E-Troll module return (if equipped). Electronic control solenoid drivers must have their solenoid return internally connected directly to ground. If not, the Profile or E-Troll Module must be interfaced to the electronic control with relays.

Table 21. Module Power Connection Chart

Wire	Wiring Option1	Wiring Option 2	Wiring Option 3
Troll Enable Switch Return (if equipped)	Connect to the Negative terminal of the engine battery.	Connect to the same ground point used by the gear controller or the engine control.	Connect to the same point as the control's power ground signal.
Solenoid B Switch	Connect to the positive terminal of the engine battery through the switch contacts used to energize Solenoid B.	Connect to the output in the gear controller that is used to energize Solenoid B.	Connect to the control's Solenoid B postive driver output.
Solenoid Return	Connect to the negative terminal of the engine battery.	Connect to the same ground point used by the gear controller or the engine control.	Connect to the control's solenoid negative output circuit.
Solenoid A	Connect to the positive terminal of the engine battery through the switch contacts used to energize Solenoid A.	Connect to the output in the gear controller that is used to energize Solenoid A.	Connect to the control's Solenoid A positive driver output.

- ❑ The customer supplied normally closed not in neutral relay must be located in a position to not be affected by vibration. The coil must have a 200 maximum current draw. The coil must be connected to the two "not in neutral" wires of the Profile Generator.
- ❑ The contacts of the manual direction control switch (closed in neutral) must be wired in series with the energizing coil of the not in neutral relay.
- ❑ Plug the appropriate connectors from the Profile Generator into the appropriate Proportional Valves.
- ❑ Plug the appropriate connectors from the Profile Generator into the Engine Speed sensor and the Propeller speed sensor (if equipped).
- ❑ When the "not in neutral" circuit is not used, insulate and secure the blue and black wires.

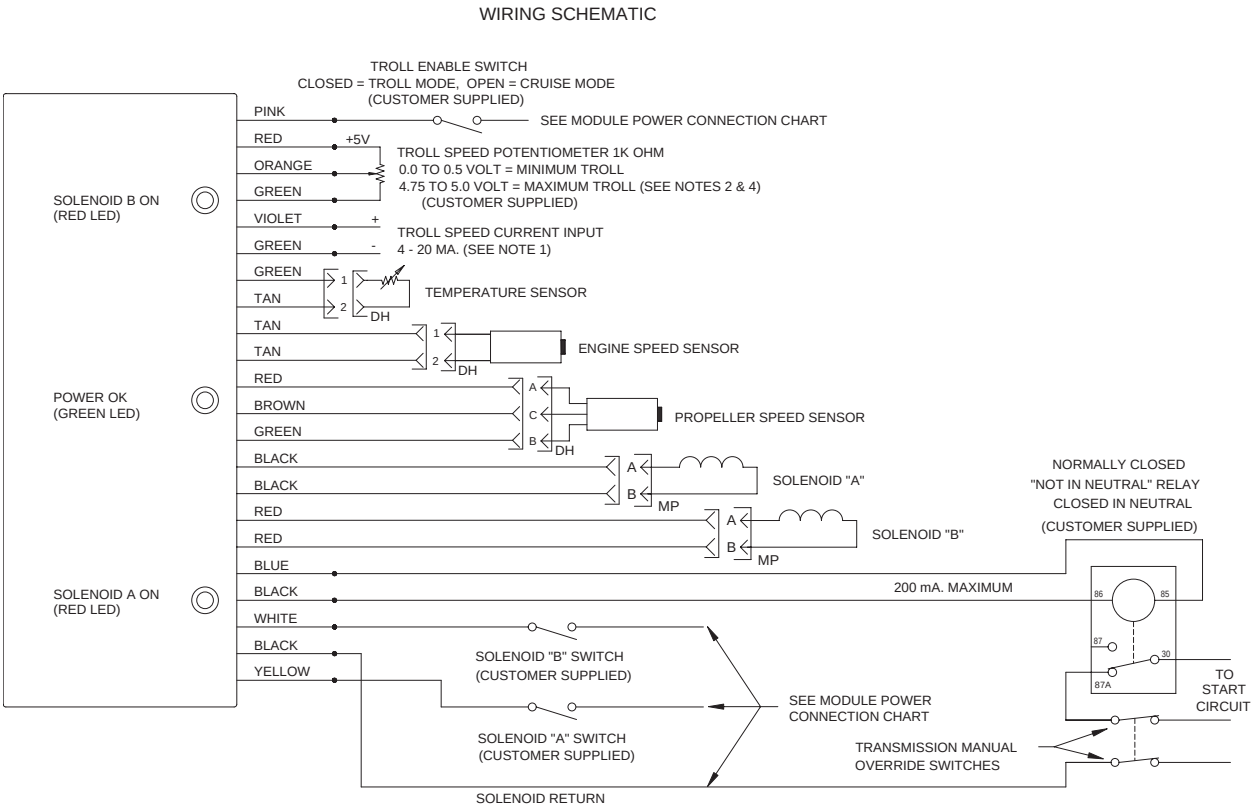


Figure 178. E-Troll Wiring Diagram

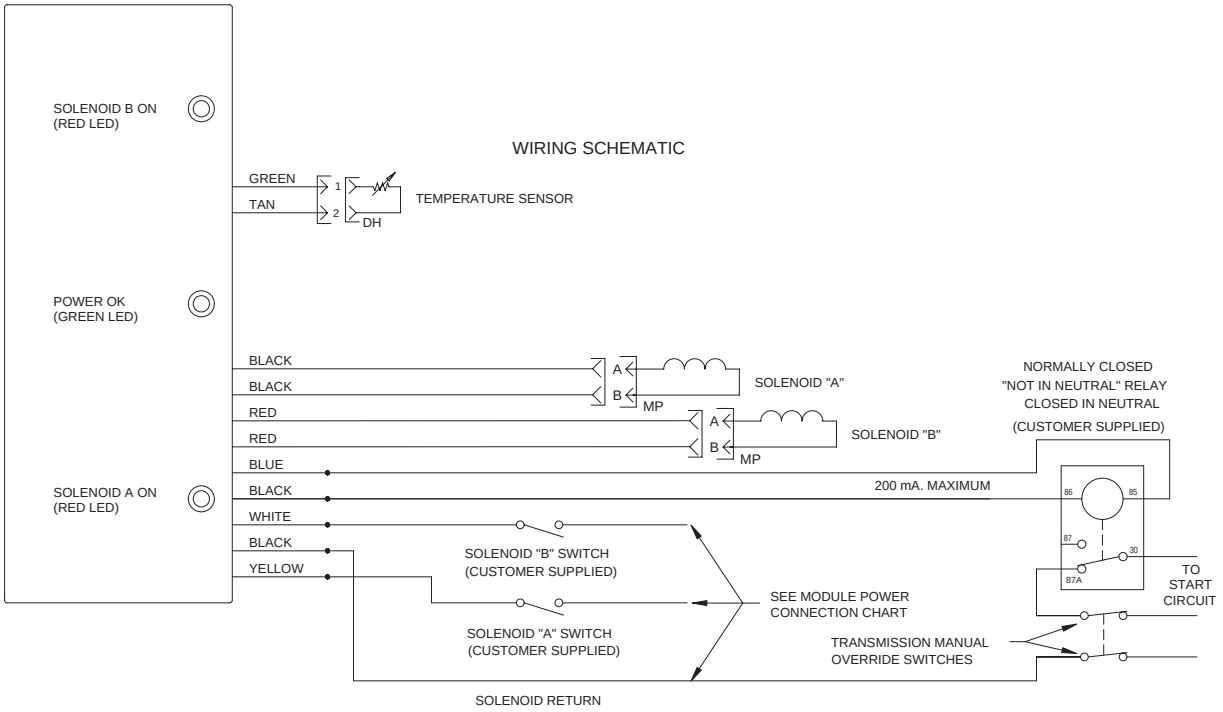


Figure 179. Profile Module Wiring Diagram

Final Checks

Be sure the transmission is filled with oil before starting. See Description and Specifications and Preventative Maintenance for proper oil and filling procedure.

Special Tools

List of Special Tools

The following pages include the special tool drawings that are specific to this model. The special tool drawings included are listed below and continued on the following page.

- ❑ T18502 Release Spring Compressor
- ❑ TD-300492 Seal Installation Input
- ❑ TD-300493 Seal Installation Output
- ❑ TD-300494 -1 Gear Installation Tool (Output Shaft)
- ❑ TD-300494 -2 Gear Installation Tool (Output Shaft)
- ❑ TD-300495 Rear Inner Bearing Race Installation (Primary and Secondary Shafts)
- ❑ TD-300496 Output Shaft Inner Bearing Race Installation
- ❑ TD-300497 Outer Bearing Race Installation (MA590BF)
- ❑ TD-300498 Outer Bearing Race Installation (MA590CS)

Recommended Pump Set and Fluids

Twin Disc recommends the following products for use in the assembly and removal of tapered shafts using the oil injection method:

THAP 300 Air-Driven Pump Set

This set consists of the air-driven pump with accessories, such as an adapter block, pressure gauge, high pressure pipe, or pressure hose with quick connection couplings and connection nipples. The set includes one of each: air-driven pump [THAP 300], adapter block [226402], pressure gauge [1077589] and high pressure pipe (2m/6.5 ft.) [227957A].

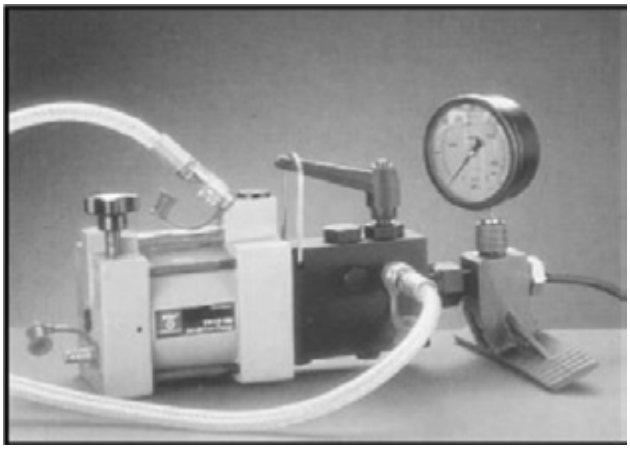


Figure 180. THAP 300 Air-driven Pump Set

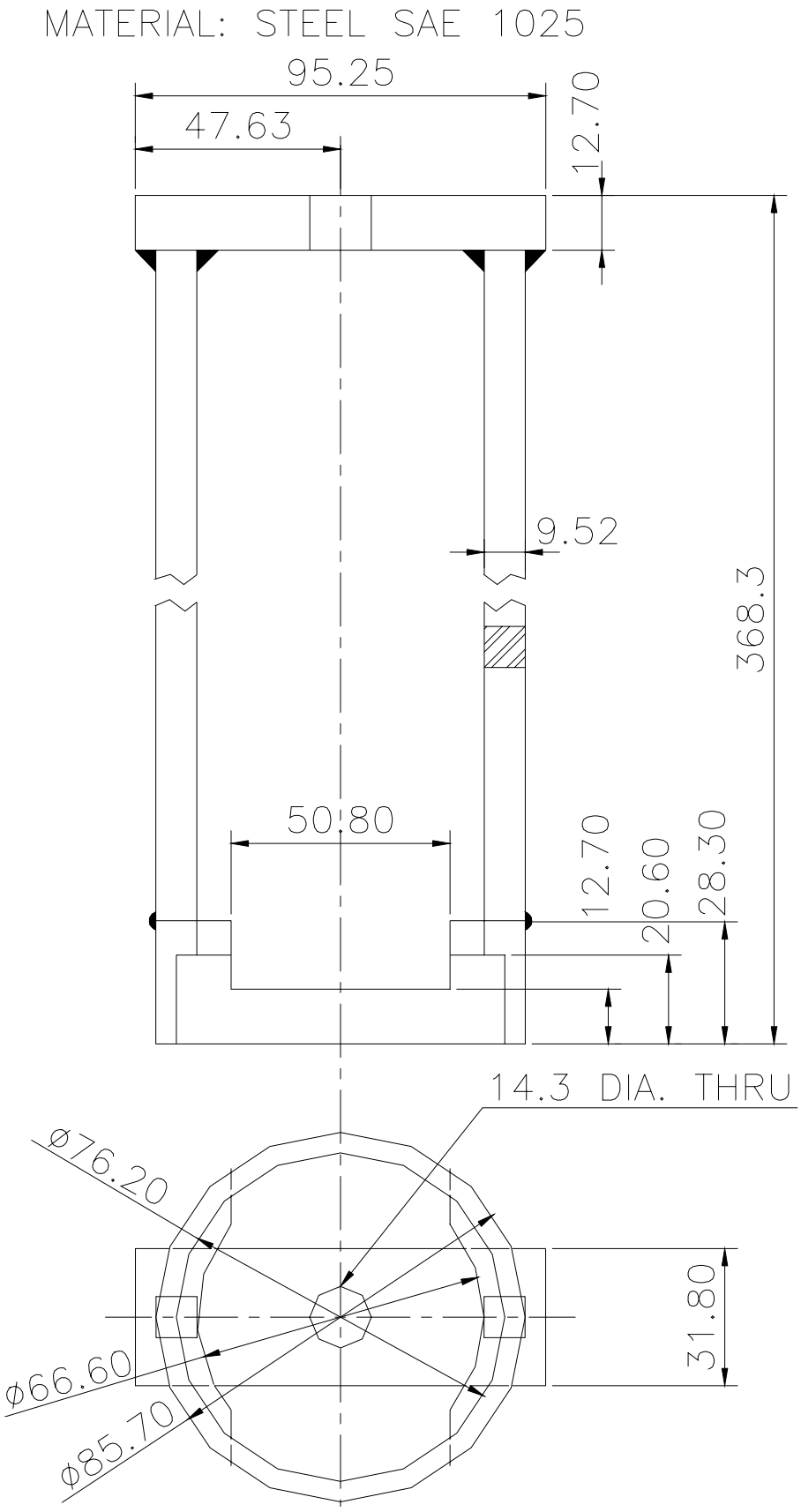
Mounting Fluid LHMF 300 and Dismounting Fluid LHDF 900

SKF LHMF 300 and LHDF 900 are recommended when using SKF hydraulic equipment like hydraulic pumps. HMV nuts, oil injection equipment, etc. The fluids contain anticorrosives and are non-aggressive to seal material like nitrile rubber, Buna N (Perbunan), chrome, leather, PTFE, etc. SKF LHMF 300 and LHDF 900 are available in 5 liter (5.3 qt.) cans. Designation: LHMF 300/5 and LHDF 900/6.

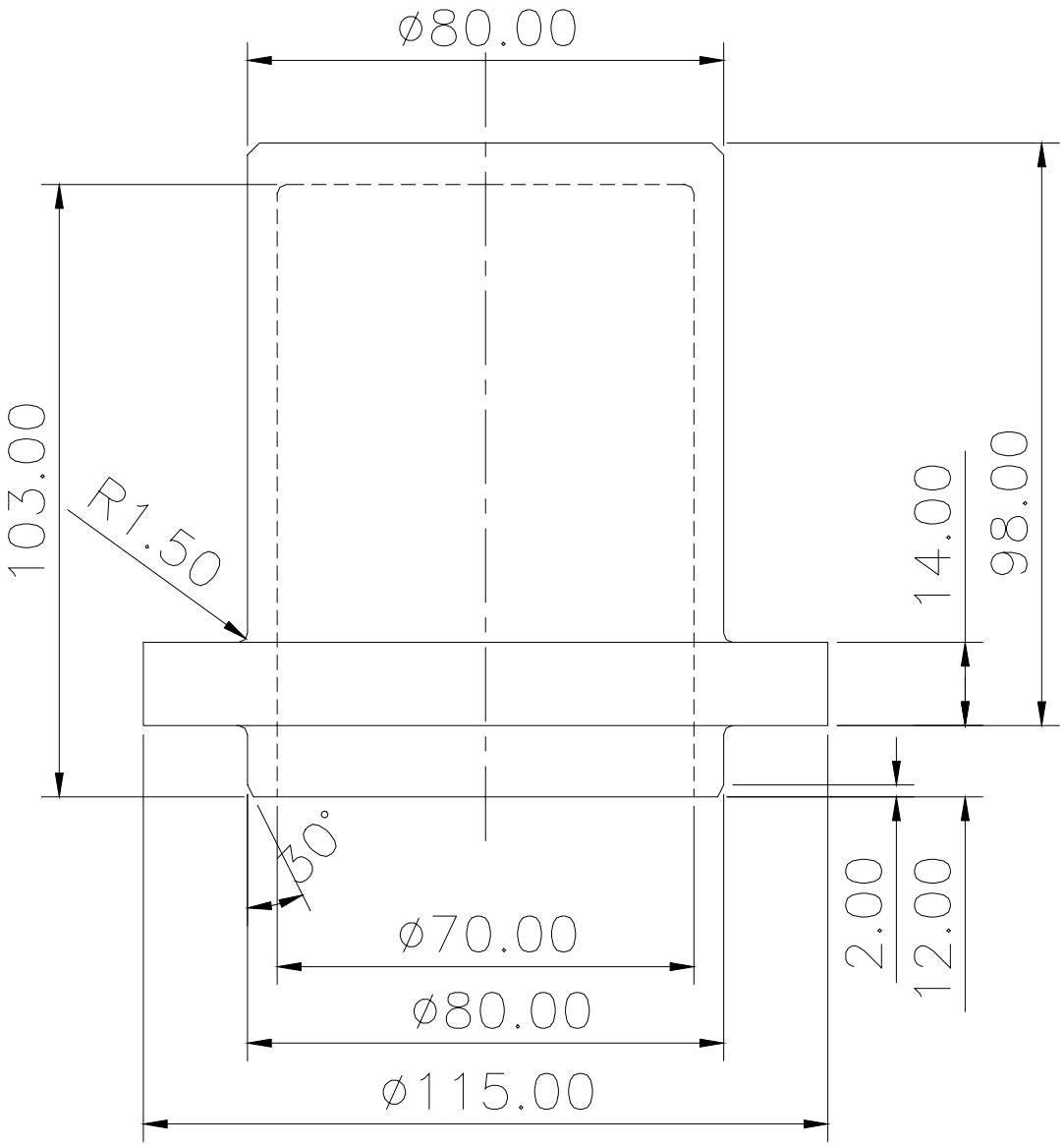
Figure 181. SKF LHMF 300 and LHDF 900

Note: Order Through Your Local Authorized SKF Distributor

T-18502 - Release Spring Compressor



TD-300492 - Seal Installation Input



Break sharp corners
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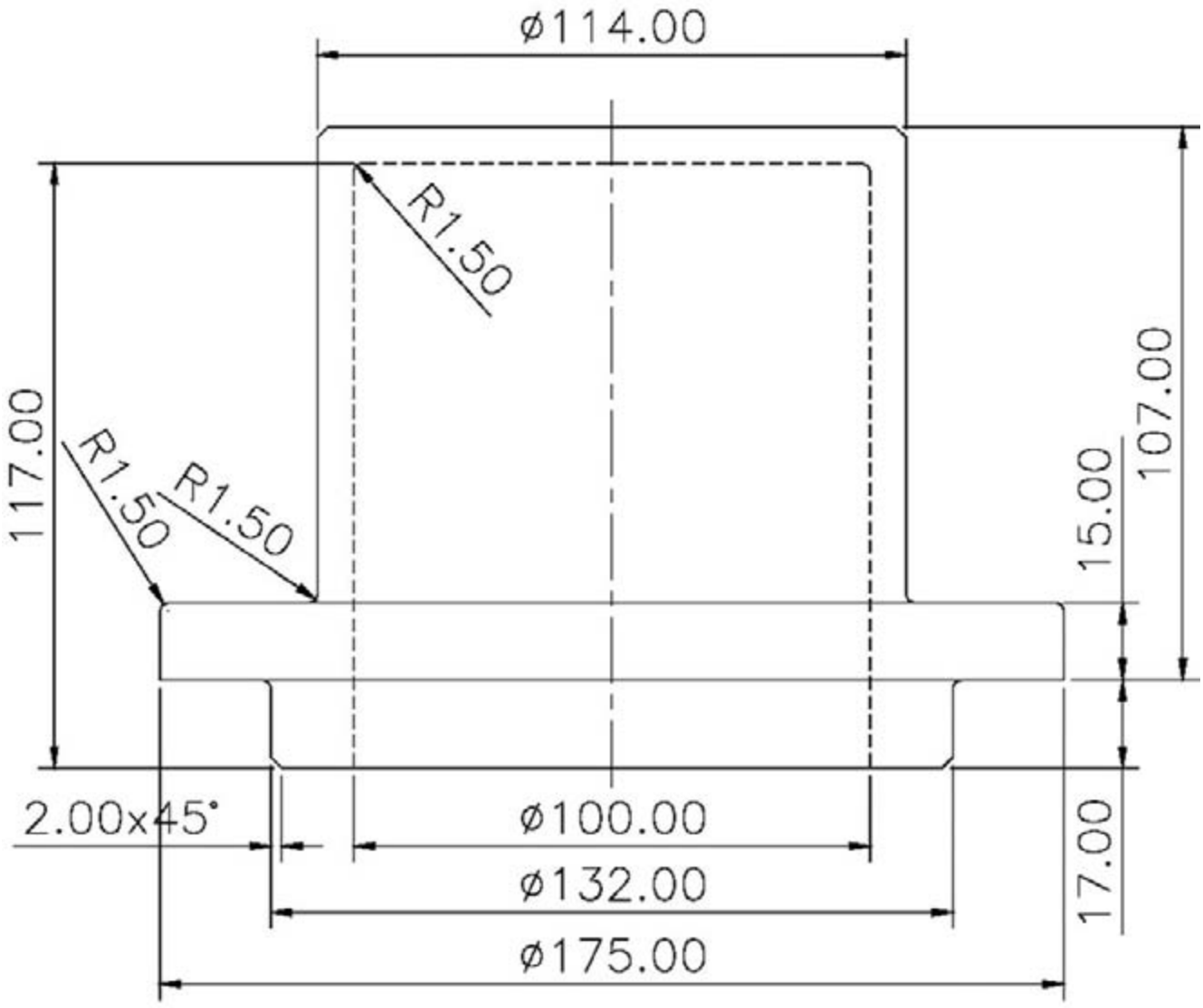
All dimensions are in mm.
Tolerance: +/– 0.1 mm.
Not at Scale

TD-300493 - Seal Installation Output



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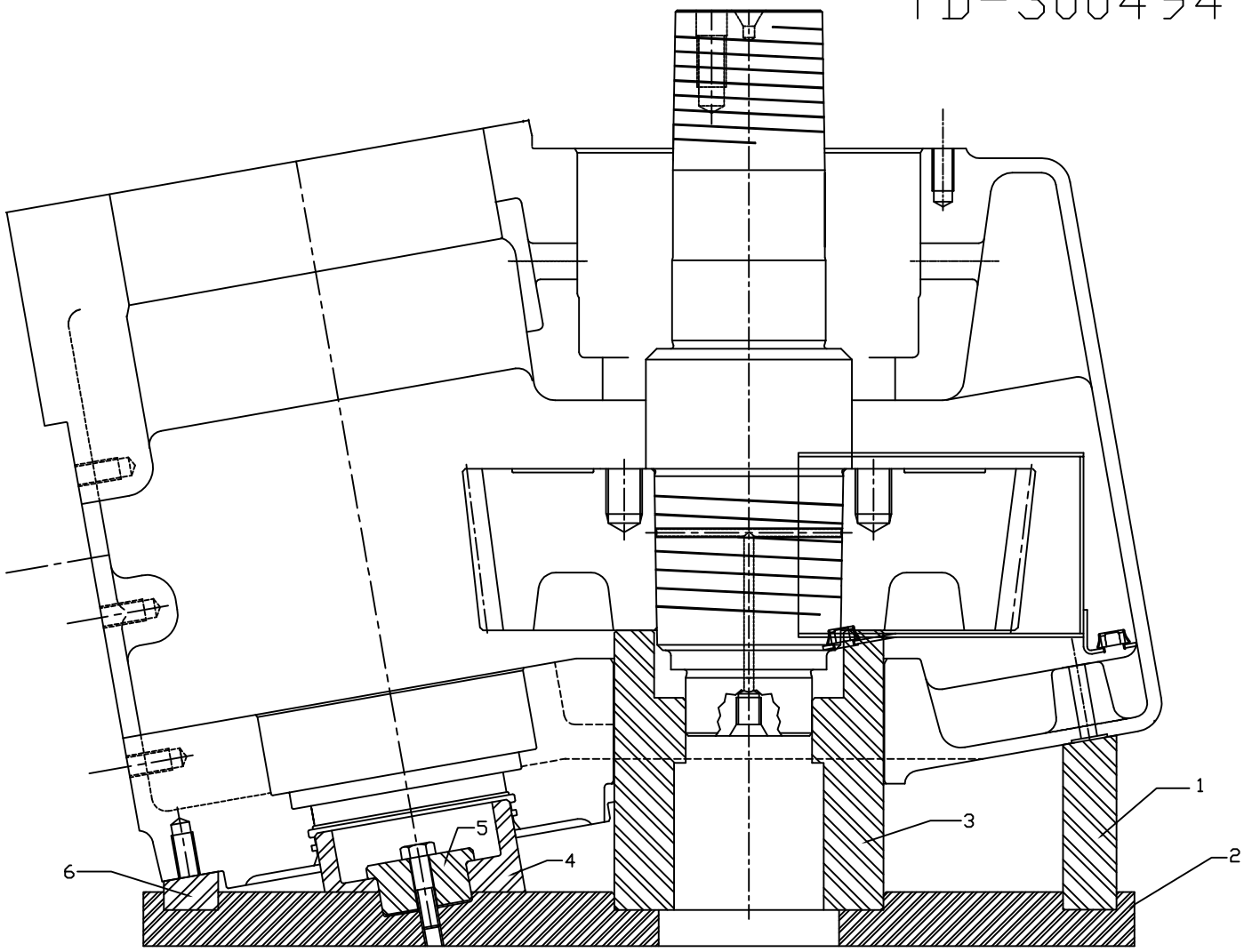
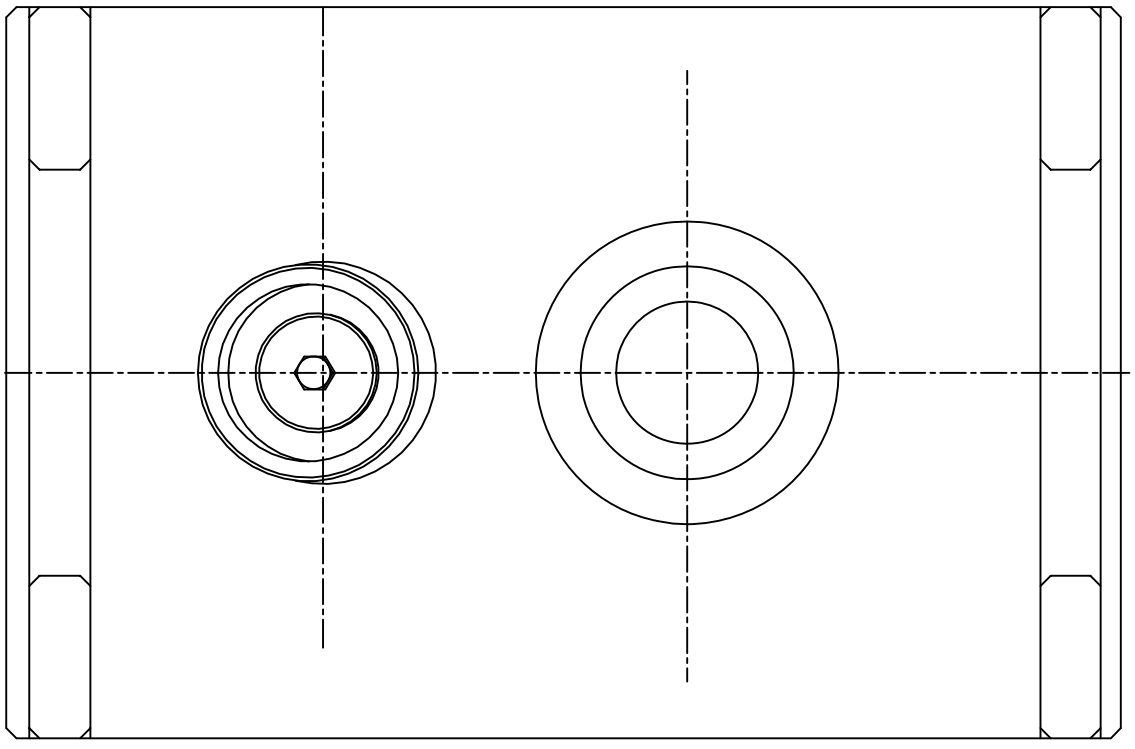
All dimensions are in mm.
Tolerance: +/– 0.1 mm.
Not at Scale

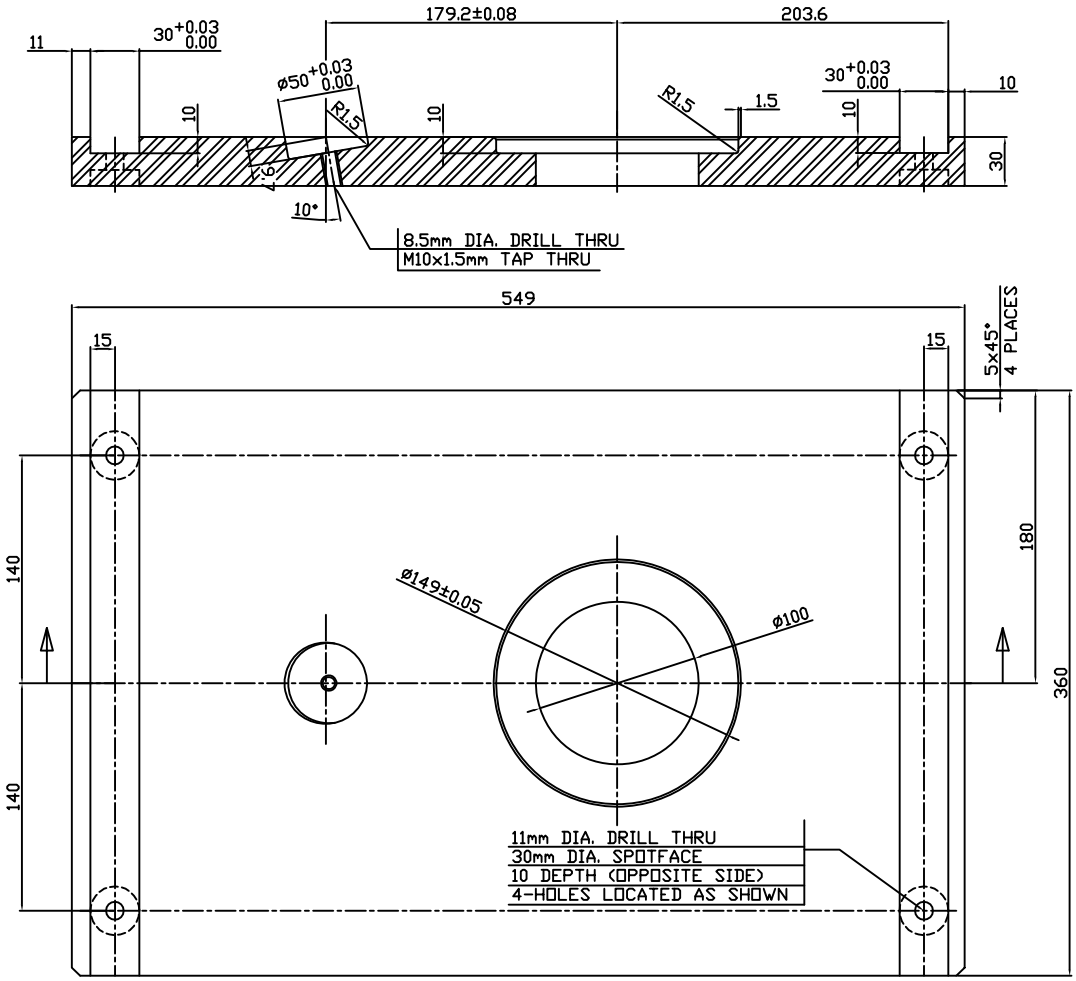
TD-300494





TD-300494

ITEM 2



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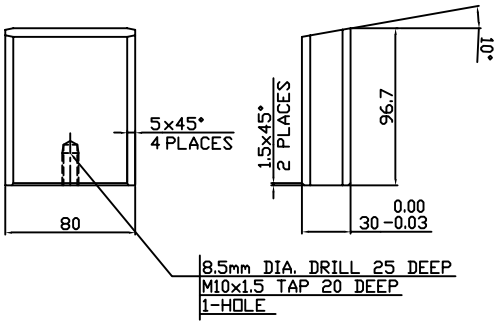
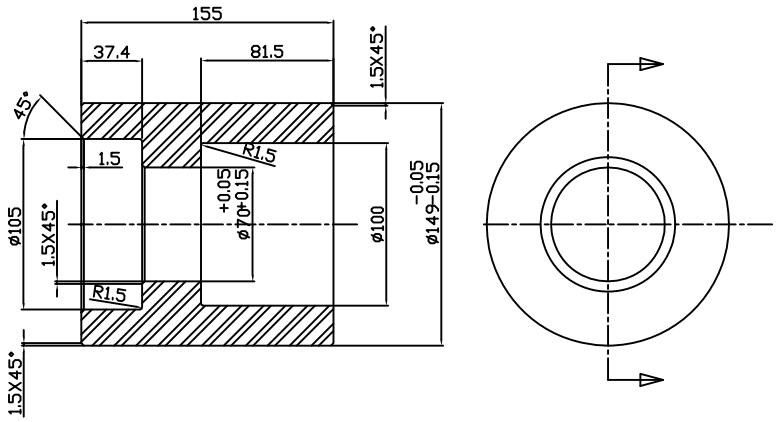


1×ITEM 3



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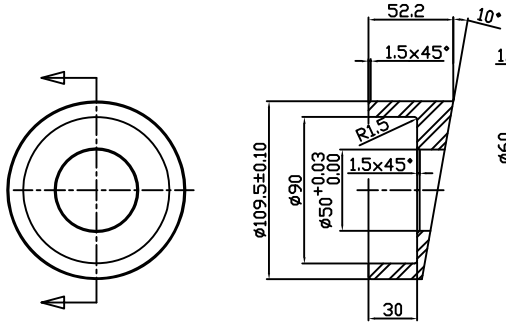

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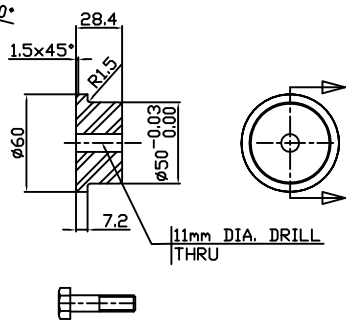
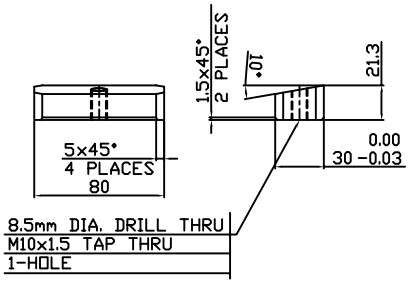
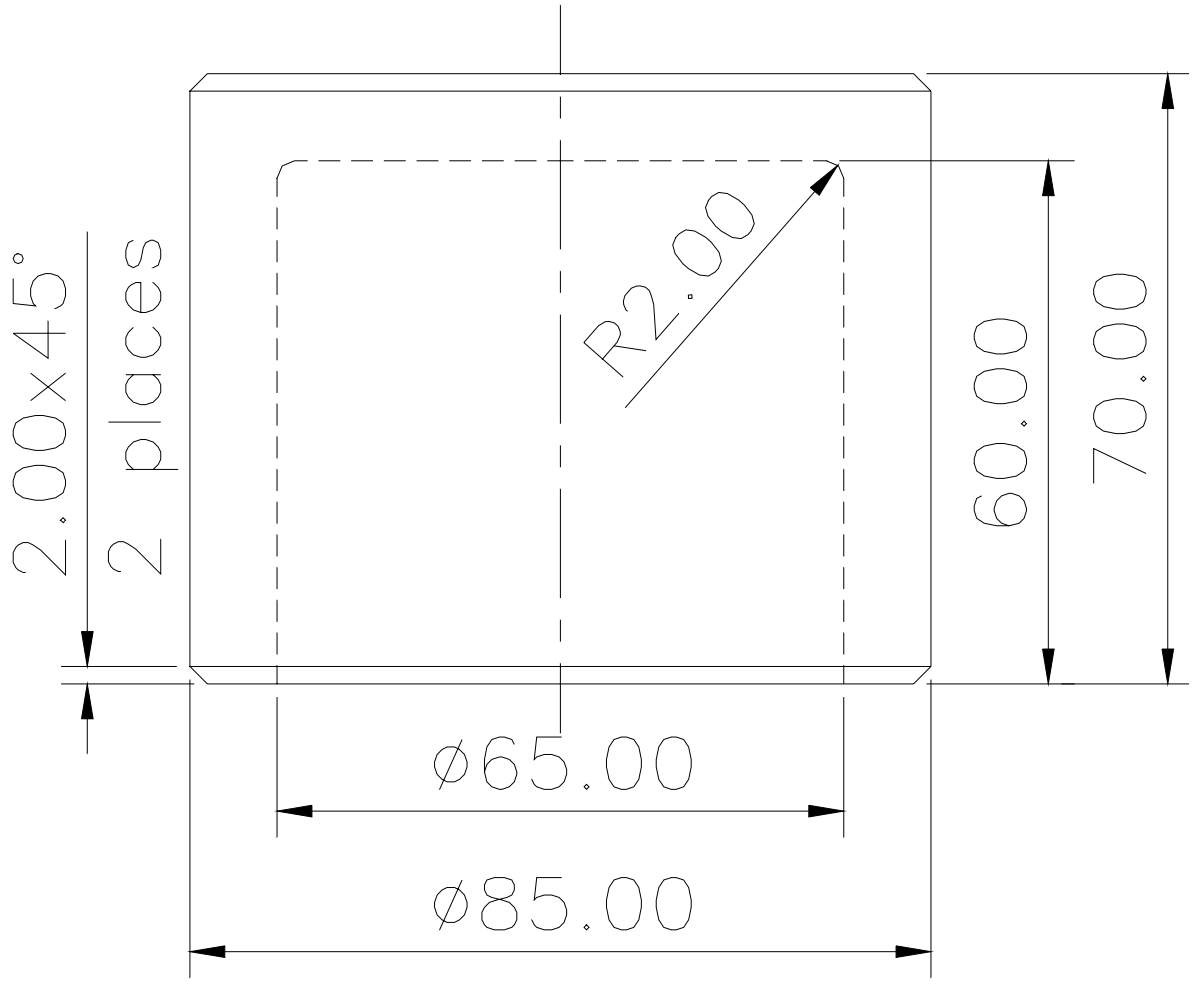


SCREW M10X40

2×ITEM 6



TD-300495 Rear Inner Bearing Race Installation (Primary and Secondary Shafts)



Break sharp corners
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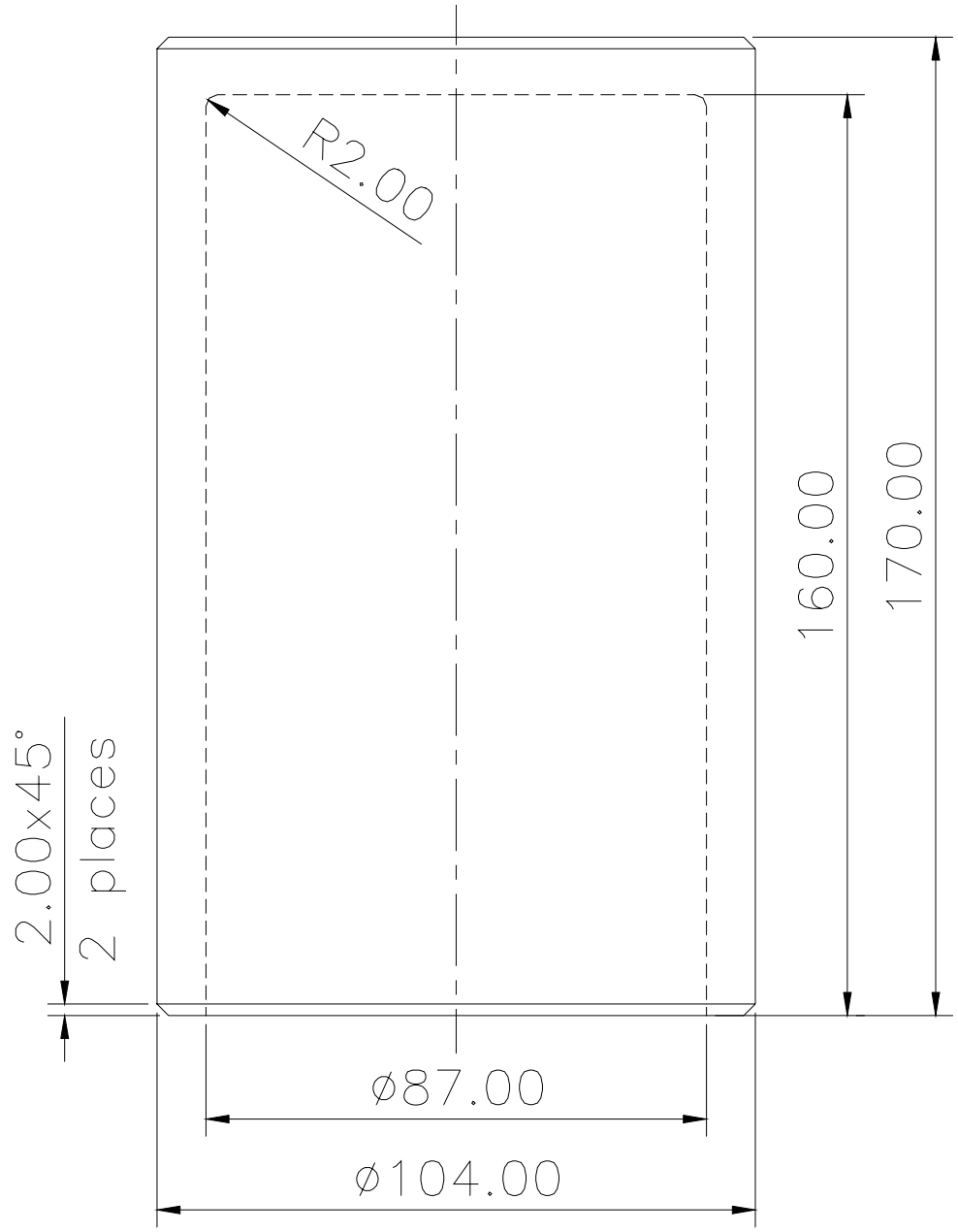
All dimensions are in mm.
Tolerance: +/– 0.1 mm.
Not at Scale

TD-300496 - Output Shaft Inner Bearing Race Installation



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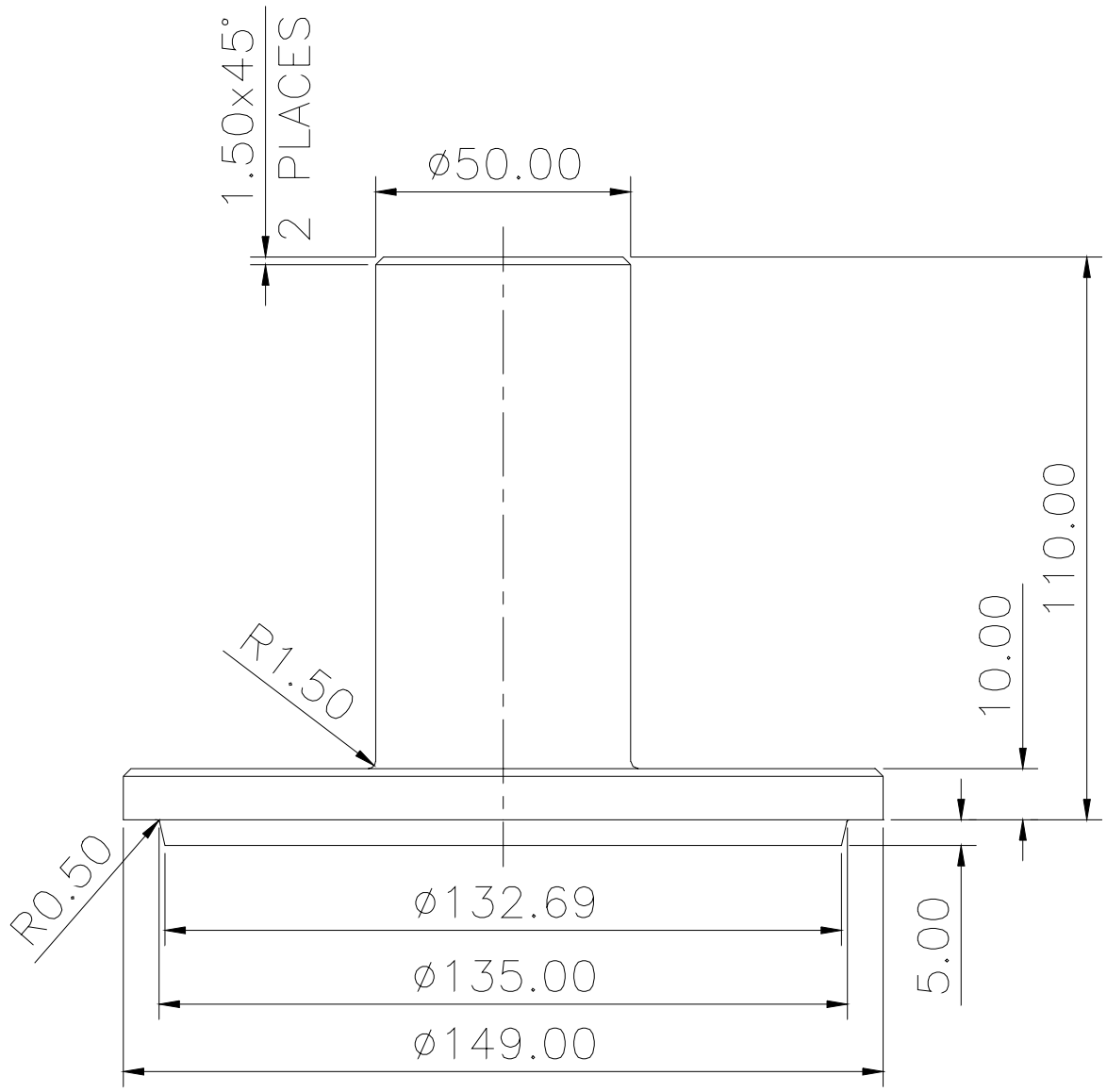
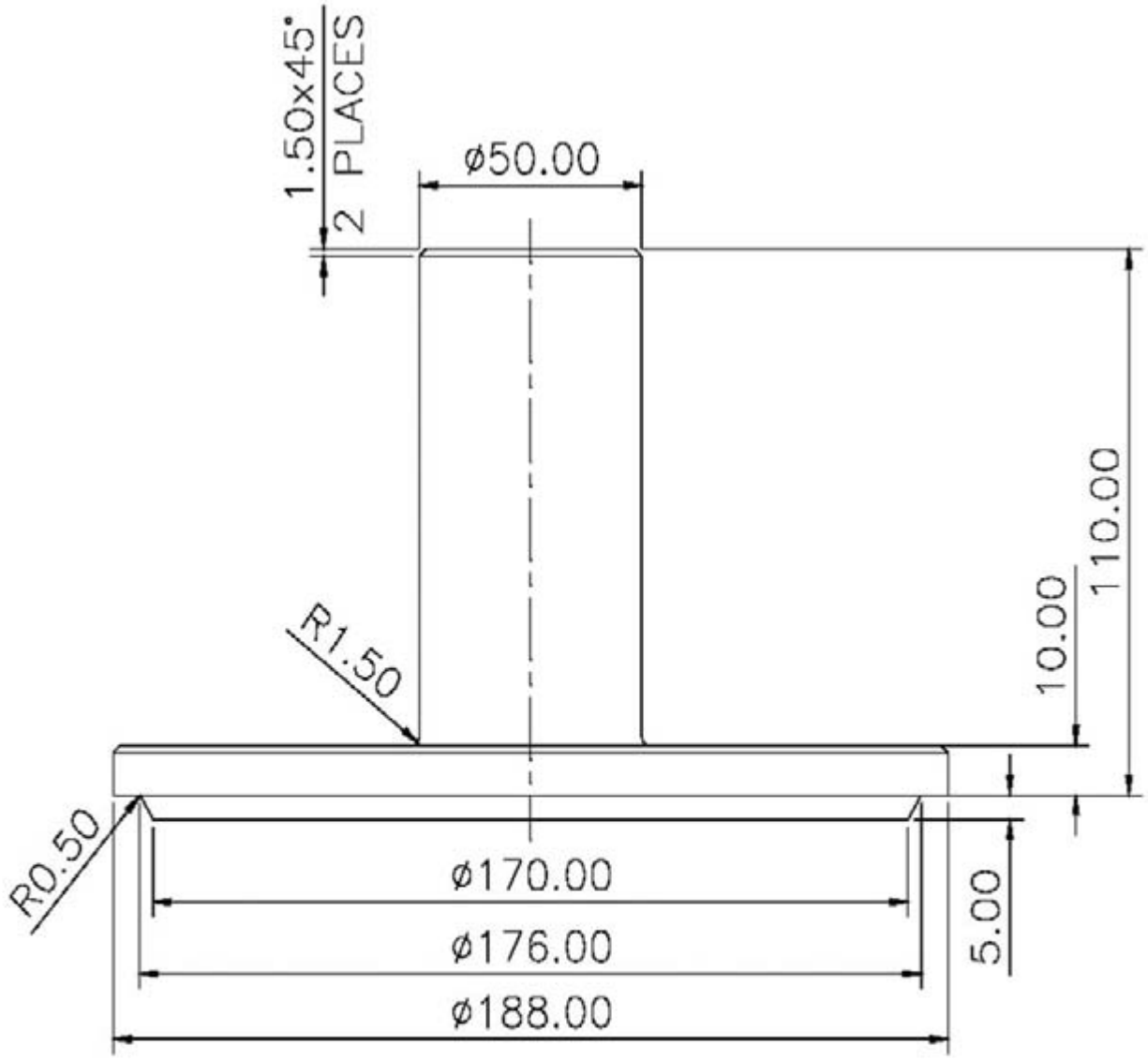
All dimensions are in mm.
Tolerance: +/– 0.1 mm.
Not at Scale

TD-300497 - Outer Bearing Race Installation (MA590BF)



Break sharp corners
Material Mo40 H.T. 40–50 HRc.
All dimensions are in mm.
Tolerance: +/– 0.1 mm.
Not at Scale

TD-300498 - Outer Bearing Race Installation (MA590CS)



Break sharp corners
Material Mo40 H.T. 40–50 HRc.
All dimensions are in mm.
Tolerance: +/– 0.1 mm.
Not at Scale

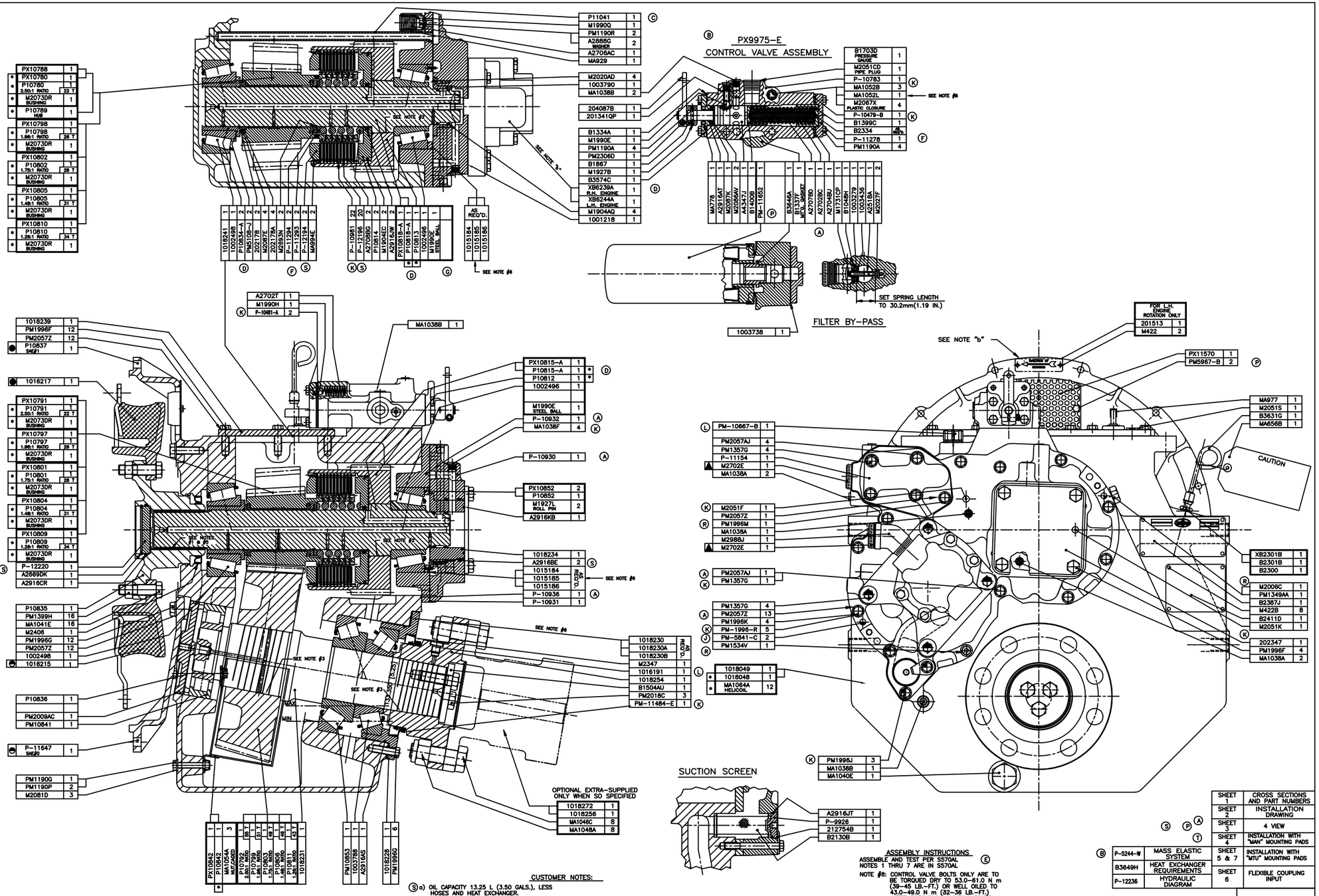
Engineering Drawings

List of Engineering Drawings

The following pages include the engineering drawings that are specific to this model. The engineering drawings included are listed below and continued on the following page.

Note: Any part numbers listed in the following engineering drawings are for reference only. Please refer to your bill of material for part numbers specific to your model.

❑	PX-10830	MG-5145A Marine Transmission, Sectional View (sheet 1 of 7)
❑	PX-10830	MG-5145A Marine Transmission, General View (sheet 2 of 7)
❑	PX-10830	MG-5145A Marine Transmission, General View (sheet 3 of 7)
❑	PX-10830	MG-5145A Marine Transmission, General View (sheet 4 of 7)
❑	PX-10830	MG-5145A Marine Transmission, General View (sheet 5 of 7)
❑	PX-10830	MG-5145A Marine Transmission, General View (sheet 6 of 7)
❑	PX-10830	MG-5145A Marine Transmission, General View (sheet 7 of 7)
❑	A7119M	MG-5145A Hydraulic Diagram
❑	PX-11615	
❑	PX-11615A	
❑	1020729	
❑	1021658	



PX10788	1
* PX10780	1
* P10780 2.50:1 RATIO 22 T	1
* M2073DR BUSHING	1
* P10789 HUB	1
PX10798	1
* P10798 1.96:1 RATIO 28 T	1
* M2073DR BUSHING	1
PX10802	1
* P10802 1.75:1 RATIO 28 T	1
* M2073DR BUSHING	1
PX10805	1
* P10805 1.48:1 RATIO 31 T	1
* M2073DR BUSHING	1
PX10810	1
* P10810 1.28:1 RATIO 34 T	1
* M2073DR BUSHING	1

P11041	1
M1990Q	1
PM1190R	2
A2888G WASHER	2
A2706AC	1
MA929	1
M2020AD	4
1003790	1
MA1038B	2
204087B	1
2013410P	1
B1334A	1
M1990E	1
PM1190A	4
PM2306D	1
B1867	1
M1927B	1
B3574C	1
XB6239A R.H. ENGINE	1
XB6244A L.H. ENGINE	1
M1904AQ	4
1001218	1

B17030 PRESSURE GAUGE	1
M2051CD PIPE PLUG	1
P-10783	1
MA1052B	3
MA1052L	1
M2067X PLASTIC CLOSURE	4
P-10479-B	1
B1399C	1
B2334	AS REQ'D.
P-11278	1
PM1190A	4

MA778	1
A2916AT	1
M2067AN	1
A4347J	1
B1400B	1
PM-11652	1
B3646A	1
B1137F	1
M2067BC	1
A2706BC	1
A2706BJ	1
M1731CP	1
B1048H	1
1003279	1
1003436	1
A2516A	1
M2027F	2

1018241	1
1002498	1
P10834-A	2
PM5108-J	2
202178	2
M2067E	2
202178A	4
M2067BN	2
P-11294	2
P-11293	2
P-12194	2
MA994E	2

P-10981	22
P-12196	20
A2706B6	2
P10814	2
M1990C	2
A2916KB	2
PX10818-A	1
P10818-A	1
P10813	1
1002496	1
M1990E STEEL BALL	1

1015184	AS REQ'D.
1015185	
1015186	

A2702T	1
M1990H	1
P-10981-A	2
MA1038B	1

1018239	1
PM1996F	12
PM2057Z	12
P10837 SAE#1	1
1016217	1
PX10791	1
* P10791 2.50:1 RATIO 22 T	1
* M2073DR BUSHING	1
PX10797	1
* P10797 1.96:1 RATIO 28 T	1
* M2073DR BUSHING	1
PX10801	1
* P10801 1.75:1 RATIO 28 T	1
* M2073DR BUSHING	1
PX10804	1
* P10804 1.48:1 RATIO 31 T	1
* M2073DR BUSHING	1
PX10809	1
* P10809 1.28:1 RATIO 34 T	1
* M2073DR BUSHING	1
S P-12220	1
A2869DK	1
A2916CR	1
P10835	1
PM1399H	16
MA1041E	16
M2406	1
PM1996G	12
PM2057Z	12
1002498	1
1016215	1
P10836	1
PM2009AC	1
PM10841	1
P-11647 SAE#2	1
PM1190G	1
PM1190P	2
M2081D	3

PX10815-A	1
P10815-A	1 *
P10812	1 *
1002496	1
M1990E STEEL BALL	1
P-10932	1
MA1038F	4
P-10930	1
PX10852	2
P10852	1
M1927L ROLL PIN	2
A2916KB	1
1018234	1
A2916BE	2
1015184	AS REQ'D.
1015185	
1015186	
P-10936	1
P-10931	1
1018230	AS REQ'D.
1018230A	
1018230B	
M2347	1
1016191	1
1018254	1
B1504AU	1
PM2018C	3
PM-11484-E	1

PX10842	1
P10842	1
MA1054A	3
MA1054B	
P10792 2.50:1 RATIO	6
P10793 1.96:1 RATIO	6
P10803 1.75:1 RATIO	6
P10806 1.48:1 RATIO	6
P10811 1.28:1 RATIO	6
1018231	1
PM10963	1
PM10978	1
A2916AS	1
1018228	1
PM1996G	6

OPTIONAL EXTRA--SUPPLIED ONLY WHEN SO SPECIFIED	
1018272	1
1018256	1
MA1046C	8
MA1048A	8

L PM-10667-B	1
PM2057AJ	4
PM1357G	4
P-11154	1
M2702E	1
MA1038A	2
K M2051F	1
PM2057Z	1
R PM1996M	1
MA1038A	1
M2988J	1
M2702E	1
A PM2057AJ	1
K PM1357G	1
PM1357G	4
A PM2057Z	13
PM1996K	4
K PM-1996-R	5
J PM-5841-C	2
R PM1534V	1
L 1018049	1
* 1018048	1
* MA1064A HELICOIL	12
K PM1996J	3
MA1038B	1
MA1040E	1

FOR L.H. ENGINE ROTATION ONLY	
201513	1
M422	2
PX11570	1
PM5967-B	2
MA977	1
M2051S	1
B3631G	1
MA656B	1
XB2301B	1
B2301B	1
B2300	1
R M2006C	1
PM1349AA	1
B2387J	1
M422B	8
B2411D	1
M2051K	1
K 202347	1
PM1996F	4
MA1038A	2

A2916JT	1
P-9926	1
212754B	1
B2130B	1

S P A T	
B P-5244-W	MASS ELASTIC SYSTEM
B3649H	HEAT EXCHANGER REQUIREMENTS
P-12236	HYDRAULIC DIAGRAM

SHEET 1	CROSS SECTIONS AND PART NUMBERS	
SHEET 2	INSTALLATION DRAWING	
SHEET 3	4 VIEW	
SHEET 4	INSTALLATION WITH "MAN" MOUNTING PADS	
SHEET 5 & 7	INSTALLATION WITH "MTU" MOUNTING PADS	
SHEET 6	FLEXIBLE COUPLING INPUT	

* NOT SERVICEABLE SEPARATELY

▲ REMOVE BEFORE OPERATING, 2 PLACES, ALUMINUM PLUGS.

● OPTIONAL FOR S.A.E. #1

◓ OPTIONAL FOR S.A.E. #0

CUSTOMER NOTES:

(S) a) OIL CAPACITY 13.25 L (3.50 GALS.), LESS HOSES AND HEAT EXCHANGER.
b) ROTATION ARROW AND PUMP POSITION FOR R.H. ENGINE IS SHOWN.FOR L.H. ENGINES,ROTATION PLATE(ARROW POINTING TO RIGHT) AND SCREWS MUST BE ADDED TO INDICATE OPPOSITE DIRECTION AND PUMP TO BE RELOCATED PER INSTRUCTIONS SHOWN ON SHEET 2.
c) OPTIONAL EQUIPMENT:
COMPANION FLANGE ASS'Y. :1018272
CONTROL TROLLING VALVE :PX-10790-D
LIVE P.T.O. PX-9768
HYDRAULIC CLUTCHED P.T.O. :PX-11615B
HYD. CLUTCHED PUMP DRIVE :PX-11615C
ELEC.CONTROL VALVE ASS'Y.:PX-10225C
(K) WITH MANUAL TROLLING VALVE ASS'Y.:PX-10530-C
(P) ELECTRIC TROLLING VALVE:1020230A

OIL TEMPERATURE INDICATING SWITCH :B3424, FOR INSTALLATION LOCATION, SEE HYDRAULIC DIAGRAM AND SHEET 2.

OIL PRESSURE GAGE :B17030 FOR INSTALLATION LOCATION, SEE HYDRAULIC DIAGRAM AND SHEET 2.

ASSEMBLY INSTRUCTIONS

ASSEMBLE AND TEST PER S570AL (E)
NOTES 1 THRU 7 ARE IN S570AL

NOTE #6: CONTROL VALVE BOLTS ONLY ARE TO BE TORQUED DRY TO 53.0--81.0 N m (39--45 LB.--FT.) OR WELL OILED TO 43.0--49.0 N m (32--36 LB.--FT.). AFTER TORQUING MOUNTING BOLTS, INSTALL M2067X PLUGS IN MOUNTING BOLT COUNTERBORES.

THESE STANDARDS APPLY:

S574-- FASTENER TORQUE REQUIREMENTS.
S692-- THRUST BEARING SHIMMING.
S765-- TAPERED JOINT ASSEMBLY.
S774-- ANAEROBIC SEALANT APPLICATION.

MAX. INPUT SPEED: 2500 R.P.M. CONSULT SALES DEPT. APPLICATION ENGINEERS FOR OTHER LIMITING CONDITIONS.

THIRD ANGLE PROJECTION
SIMILAR TO

LB.--FT. TORQUE AND GALLONS SHOWN IN (BRACKETS).

SHT:NO.	REV	ZONE	CN. NO.	DATE
SHT:1	F		6195	26MAY00
SHT:1	E		6168	27APR00
SHT:1	D		6071	22NOV99
SHT:1	C		6035	9AUG99
SHT:1	B		5978	7APR99
SHT:1	A		5924	7DEC98
SHT:4	M		6581	27FEB02
SHT:1	L		6440	08AUG01
SHT:1	K		6399	19APR01
SHT:1	J		6376	22MAR01
SHT:5	H		6335	12FEB01
SHT:1	G		6268	14NOV00
SHT:4	T		7187	03JUN04
SHT:1	S		7153	23APR04
SHT:1	R		6937	21AUG03
SHT:4	Q		6886	05JUNE03
SHT:2	P		6742	18NOV02
SHT:3	N		6682	14AUG02

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GEAR RATIOS: 1.28 :1, 1.48 :1, 1.75 :1, 1.96 :1, 2.50 :1

	WEIGHT	lb*
	LBS.	LBS. IN.²
FIRST USE		
ASSY.		
MODEL		
NAME	MG--5145A MARINE TRANSMISSION	

DATE	12JUN08
SCALE	1/2
DRN.	RZ
DSG.	VR
APPD.	PJC

TWIN DISC INCORPORATED RACINE, WISCONSIN

PX--10830

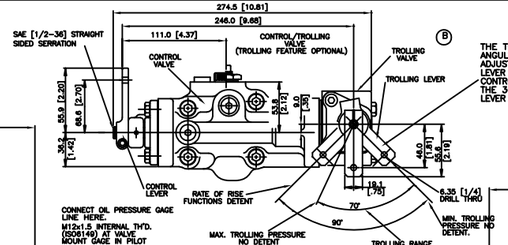
SHEET 1 REV T

(OPTIONAL) TROLLING VALVE INSTALLATION AND OPERATING NOTES:

1) REFER TO VALVE ASSEMBLY DRAWING FOR ADDITIONAL INSTALLATION NOTES. CONTROL HEAD FOR TROLLING VALVE MUST INCLUDE A DEVICE TO LOCK TROLLING VALVE CONTROL LEVER IN THE DETENTED NO-TROLL POSITION DURING MANEUVERING, DOCKING AND OTHER OPERATING CONDITIONS THAT REQUIRE FULL POWER TO THE PROPELLER.

2) MAXIMUM ENGINE SPEED WHILE TROLLING 1100 RPM OR 60% OF FULL-LOAD ENGINE SPEED, WHICHEVER IS SMALLER.

3) WITH CONTROL VALVE LEVER IN NEUTRAL, SELECT TROLLING FUNCTION BY MOVING TROLLING CONTROL LEVER OUT OF LOCKED DETENTED POSITION TO MAXIMUM TROLLING POSITION. SELECT TROLLING DIRECTION OF TRAVEL BY MOVING CONTROL VALVE LEVER TO THE PRIMARY CLUTCH OR SECONDARY CLUTCH POSITION. MOVE TROLLING CONTROL LEVER POSITION TO SELECT DESIRED TROLLING SPEED. WHEN TROLLING LEVER IS ADVANCED CLOSE TO DETENTED NO-TROLL POSITION, THE TROLLING CLUTCH MAY ENGAGE FULLY.

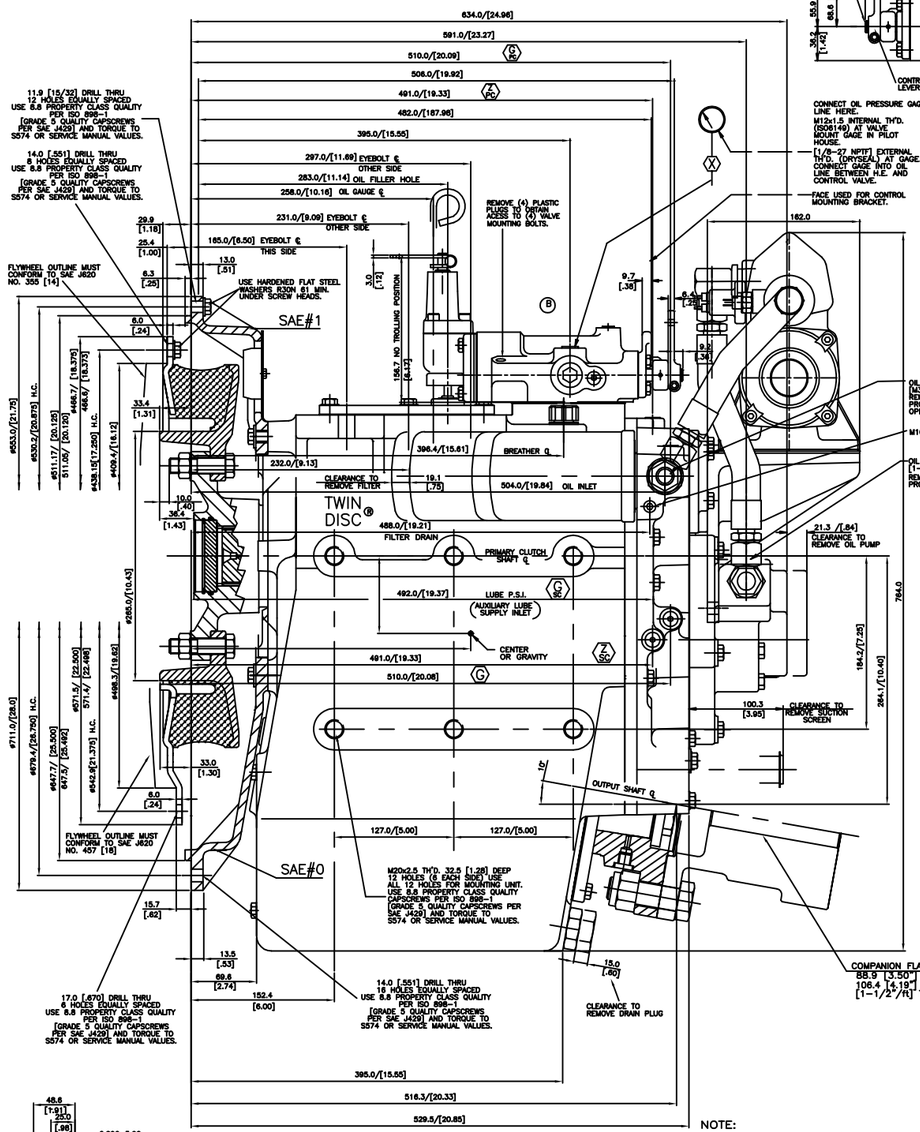

SAE [1/2-36] STRAIGHT SIDED SERRATION
274.5 [10.81]
246.0 [9.68]
111.0 [4.37]
CONTROL/TROLLING VALVE (TROLLING FEATURE OPTIONAL)
CONTROL VALVE
TROLLING VALVE
TROLLING LEVER
CONTROL LEVER
RATE OF RISE FUNCTIONS DETENT
6.35 [1/4] DRILL THRU
MIN. TROLLING PRESSURE NO DETENT.
MAX. TROLLING PRESSURE NO DETENT
TROLLING RANGE
70°
90°
CONNECT OIL PRESSURE GAGE LINE HERE.
M12x1.5 INTERNAL THʼD. (ISO8149) AT VALVE MOUNT GAGE IN PILOT HOUSE
1/8-27 NPTF] EXTERNAL THʼD. (DRYSEAL) AT GAGE. CONNECT GAGE INTO OIL LINE BETWEEN H.E. AND CONTROL VALVE.
FACE USED FOR CONTROL MOUNTING BRACKET.

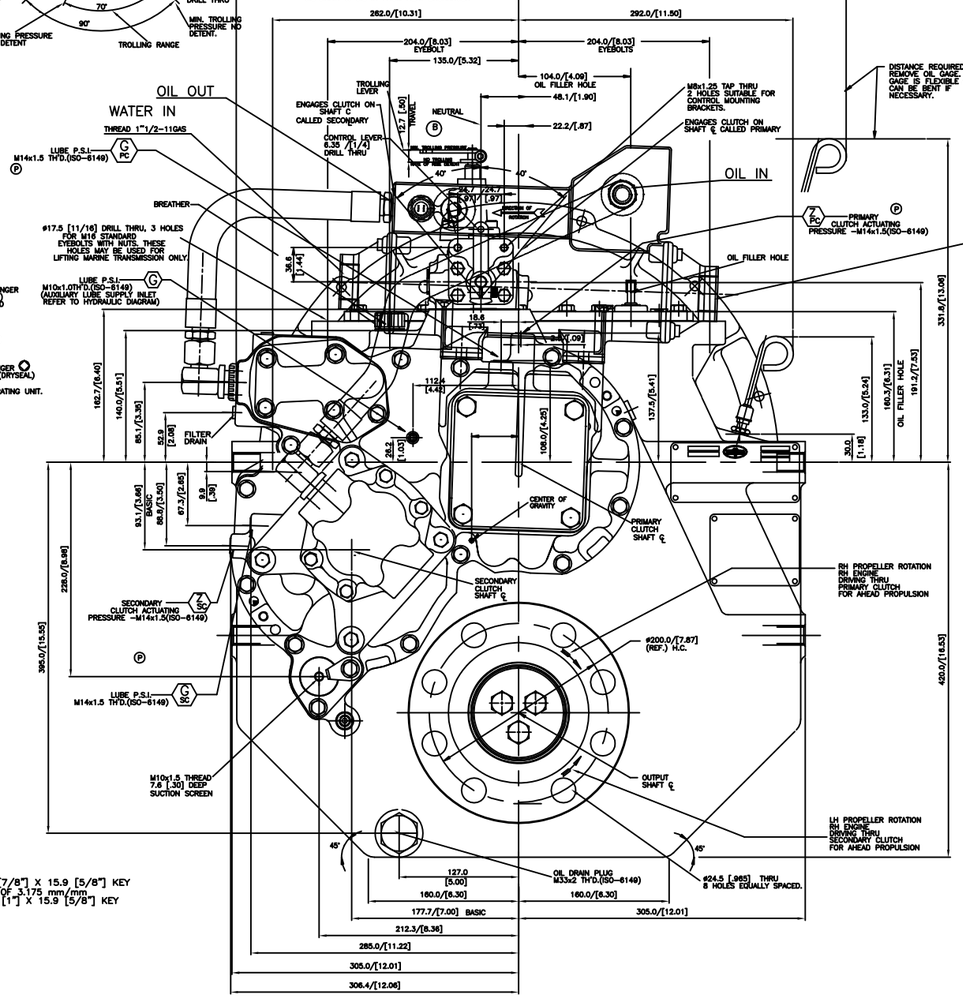
THE TROLLING LEVER ANGULAR LOCATION MAY BE ADJUSTED SO THAT THE 90° LEVER ROTATION REQUIRED FOR CONTROL FALLS ANYWHERE WITHIN THE 360° RANGE IN WHICH THE LEVER MAY BE LOCATED.

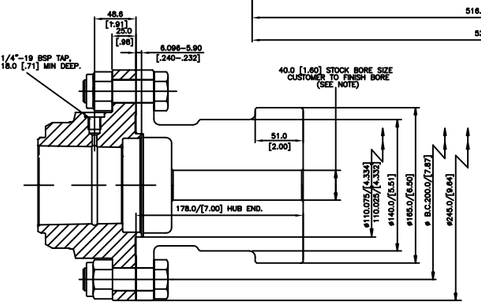
HEAT EXCHANGER (H.E.) REQUIREMENTS
REFER TO B3649H FOR HEAT EXCHANGER DATA.

CONTROL VALVE:

44.4-133N [10-30 LBS.] AT THE 56.0 [2.20]R LOCATION OF THE 6.35 [1/4] DIA. HOLE IS REQUIRED TO OVERCOME DETENT EFFORT. THE DETENT FEATURE IS PROVIDED IN THE FULL PRIMARY CLUTCH, FULL SECONDARY CLUTCH AND NEUTRAL LEVER POSITIONS. (THE DETENT SPRING AND PIN MAY BE OMITTED WHEN REMOTE CONTROL SYSTEMS PROVIDE THE PRIMARY, NEUTRAL AND SECONDARY DETENTS THAT CORRESPOND EXACTLY WITH VALVE DETENT POSITIONS. FORCE AT THE LEVER HOLE TO OPERATE THE VALVE THEN REDUCES TO 13-31N [3-7 LBS.] THE REMOTE CONTROL VALVE ACTUATOR MUST PROVIDE ± 35.8 [1.41] LINEAR TRAVEL FROM NEUTRAL AT THE 6.35 [1/4] DIA. HOLE LOCATION. ROTATIONAL STOPS AT THE STATED VALVE TRAVEL LIMITS HAVE A MAXIMUM CAPACITY OF 445N [100 LBS.] AT THE 6.35 [1/4] DIA. HOLE LOCATION. VALVE ACTUATORS WITH FORCE CAPABILITY EXCEEDING THIS LIMIT MUST HAVE SEPARATE STOPPING DEVICES SO CAPACITY OF THE VALVE ROTATIONAL STOPS IS NOT EXCEEDED. EXCEEDING THE CAPACITY OF THE VALVE ROTATIONAL STOPS CAN CAUSE LOSS OF CONTROL.


634.0[24.96]
591.0[23.27]
510.0[20.09]
508.0[19.92]
491.0[19.33]
482.0[18.98]
395.0[15.55]
297.0[11.69] EYEBOLT ℄ OTHER SIDE
283.0[11.14] OIL FILLER HOLE
258.0[10.16] OIL GAUGE ℄
231.0[9.09] EYEBOLT ℄ OTHER SIDE
185.0[6.50] EYEBOLT ℄ THIS SIDE
11.9 [15/32] DRILL THRU 12 HOLES EQUALLY SPACED USE 8.8 PROPERTY CLASS QUALITY PER ISO 898-1 [GRADE 5 QUALITY CAPSCREWS PER SAE J429] AND TORQUE TO S574 OR SERVICE MANUAL VALUES.
14.0 [.551] DRILL THRU 8 HOLES EQUALLY SPACED USE 8.8 PROPERTY CLASS QUALITY PER ISO 898-1 [GRADE 5 QUALITY CAPSCREWS PER SAE J429] AND TORQUE TO S574 OR SERVICE MANUAL VALUES.
REMOVE (4) PLASTIC PLUGS TO OBTAIN ACCESS TO (4) VALVE MOUNTING BOLTS.
162.0
29.9 [1.18]
25.4 [1.00]
6.3 [.25]
13.0 [.51]
USE HARDENED FLAT STEEL WASHERS 8.0H 61 MIN. UNDER SCREW HEADS.
SAE#1
FLYWHEEL OUTLINE MUST CONFORM TO SAE J620 NO. 355 [14]
6.0 [.24]
33.4 [1.31]
3.0 [.12]
156.7 NO TROLLING POSITION [6.17]
9.7 [.38]
9.4 [.37]
9.6 [.38]
ø530.2[20.875] H.C.
ø511.17 [20.125]
511.05/ [20.100]
ø466.7 [18.375]
466.6/ [18.370]
ø438.15[17.250] H.C.
ø409.4[16.12]
ø355.0[13.97]
ø265.0[10.43]
ø711.0[28.0]
ø679.4[26.750] H.C.
ø647.7 [25.500]
647.55/ [25.492]
ø571.5/ [22.500]
571.4/ [22.496]
ø498.3[19.62]
ø542.8[21.370] H.C.
396.4[15.61] BREATHER ℄
232.0[9.13]
CLEARANCE TO REMOVE FILTER
19.1 [.75]
504.0[19.84] OIL INLET
TWIN DISC
488.0[19.21] FILTER DRAIN
PRIMARY CLUTCH SHAFT ℄
492.0[19.37]
LUBE P.S.I. (AUDGILARY LUBE SUPPLY INLET)
CENTER OR GRAVITY
491.0[19.33]
510.0[20.08]
OIL IN FROM HEAT EXCHANGER (M33X2) THʼD. (ISO-6149) REMOVE ALUMINUM THREAD PROTECTOR BEFORE OPERATING UNIT.
M10X1 THREAD(ISO-6149)
OIL OUT TO HEAT EXCHANGER (1-11 1/2 NPTF) THʼD. (DRYSEAL) REMOVE ALUMINUM THREAD PROTECTOR BEFORE OPERATING UNIT.
21.3 /.84 CLEARANCE TO REMOVE OIL PUMP
784.0
ø284.2[11.25]
ø264.1[10.40]
100.3 [3.95] CLEARANCE TO REMOVE SUCTION SCREEN
OUTPUT SHAFT ℄
127.0[5.00]
127.0[5.00]
SAE#0
M20x2.5 THʼD. 32.5 [1.28] DEEP 12 HOLES (6 EACH SIDE) USE 14.12 HOLES FOR MOUNTING UNIT. USE 8.8 PROPERTY CLASS QUALITY CAPSCREWS PER ISO 898-1 GRADE 5 QUALITY CAPSCREWS PER SAE J429) AND TORQUE TO S574 OR SERVICE MANUAL VALUES.
15.7 [.62]
13.5 [.53]
69.6 [2.74]
152.4 [6.00]
17.0 [.670] DRILL THRU 6 HOLES EQUALLY SPACED USE 8.8 PROPERTY CLASS QUALITY PER ISO 898-1 [GRADE 5 QUALITY CAPSCREWS PER SAE J429] AND TORQUE TO S574 OR SERVICE MANUAL VALUES.
14.0 [.551] DRILL THRU 16 HOLES EQUALLY SPACED USE 8.8 PROPERTY CLASS QUALITY PER ISO 898-1 [GRADE 5 QUALITY CAPSCREWS PER SAE J429] AND TORQUE TO S574 OR SERVICE MANUAL VALUES.
15.0 [.60] CLEARANCE TO REMOVE DRAIN PLUG
COMPANION FLANGE MAX. BORES: 88.9 [3.50] DIA. WITH 22.2 [7/8"] X 15.9 [5/8"] KEY
106.4 [4.19"] DIA. AT HUB END OF 3.175 mm/mm [1-1/2"/ft] TAPER WITH 25.4 [1"] X 15.9 [5/8"] KEY
395.0/[15.55]
516.3/[20.33]
529.5/[20.85]

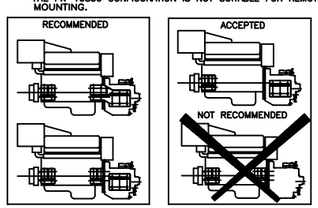




NOTE:

WHEN MOUNTING ENGINE/TRANSMISSION IN BOAT, ALL THE MOUNTING PADS ON THE ENGINE MUST BE USED -- PLUS THE TRANSMISSION SIDE MOUNTING PADS. FAILURE TO DO SO MAY RESULT IN DAMAGE TO TRANSMISSION. SEE BELOW:

THE PX-10830 CONFIGURATION IS NOT SUITABLE FOR REMOTE MOUNTING.



METRIC

EXCEPT FOR INCH DIMENSIONS AND POUNDS SHOWN IN BRACKETS [ ]

OPTIONAL TEMPERATURE INDICATING SWITCH:
CUSTOMER TO INSTALL IN A [5/4" X 3/4" X 3/4"] PIPE TEE IN THE HYDRAULIC LINE LEADING FROM THE MARINE TRANSMISSION PUMP TO THE HEAT EXCHANGER INLET. REFER TO HYDRAULIC DIAGRAM.

NOTE:
ALL POINTS AVAILABLE FOR TESTING ARE CODED ⬡.

LB.-FT. TORQUE AND GALLONS SHOWN IN BRACKETS.

MAX. INPUT SPEED: 2500 R.P.M. CONSULT SALES DEPT. APPLICATION ENGINEERS FOR OTHER LIMITING CONDITIONS.

THIRD ANGLE PROJECTION

SIMILAR TO 1003728

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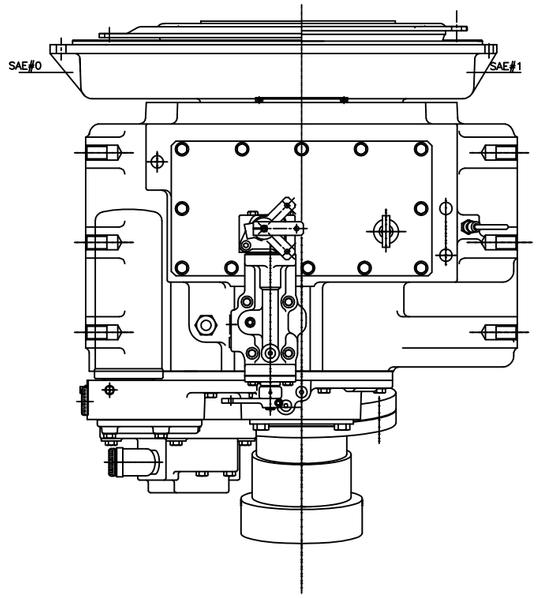
GEAR RATIOS: 1.26 :1; 1.48 :1, 1.78 :1, 1.96 :1, 2.50 :1

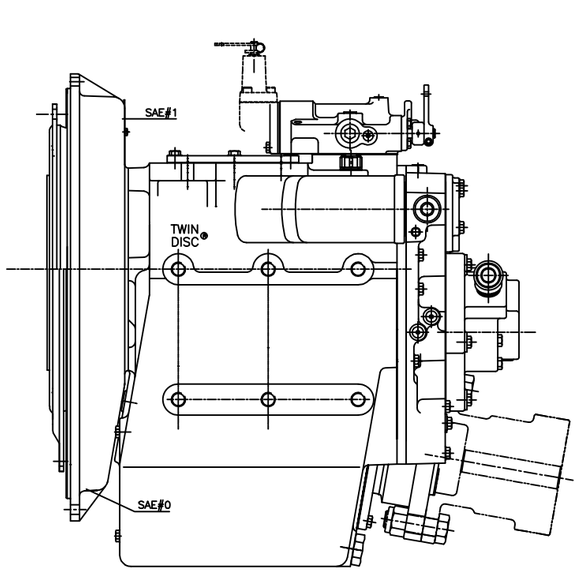
MG5145-A MARINE TRANSMISSION

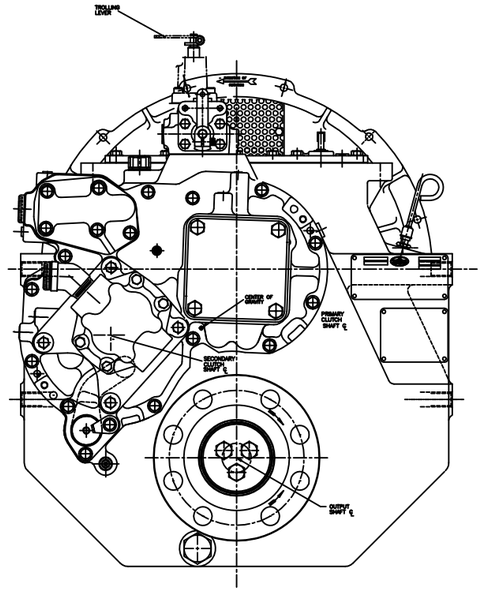
DATE	8JULY98
SCALE	1/2
DRN.	RZ
CHK.	VR
APPVD.	PJC
SHEET 2	REV T

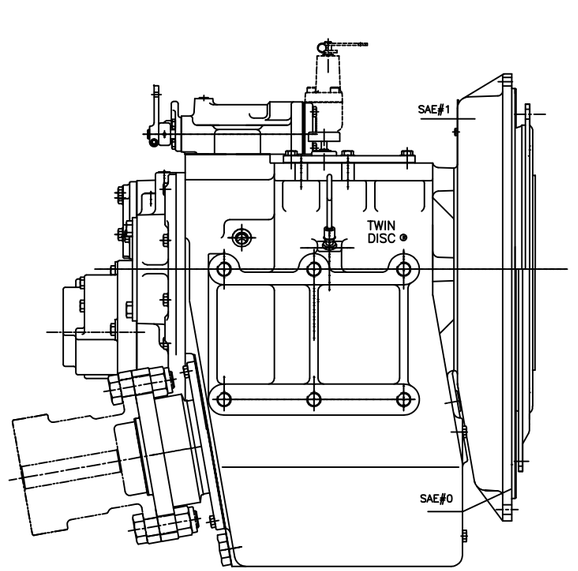
TWIN DISC INCORPORATED RACINE, WI 53403 -- USA

PX-10830









SCALE 0 20 40 60 mm / 0 1.0 2.0 3.0 INCH

THIRD ANGLE PROJECTION

SIMILAR TO

NOTICE! THIS PRINT CONTAINS PROPRIETARY INFORMATION AND IS NOT TO BE USED IN ANY MANNER DETRIMENTAL TO THE INTERESTS OF TWIN DISC, INCORPORATED RACINE, WI 53403 – USA
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MATERIAL	WEIGHT LBS.	WR² LBS. IN²	DATE 8JULY98
HEAT TREAT	FIRST USE		SCALE .25=1.00
	ASSY.		DRN. RZ
	MODEL		CHK. VR
SURFACE TREATMENT	NAME MG5145-A MARINE TRANSMISSION (REF. PX-10830)		APPD. PJC

TWIN DISC INCORPORATED RACINE, WI 53403 – USA

PX-10830

SHEET 3 REV I

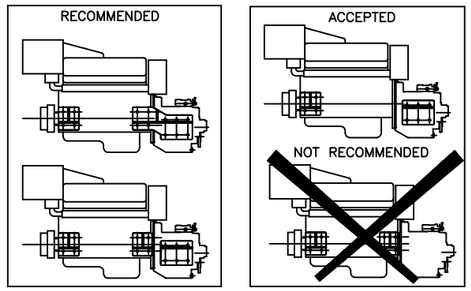
F E D C B A

6 5 4 3 2 1

NOTE:

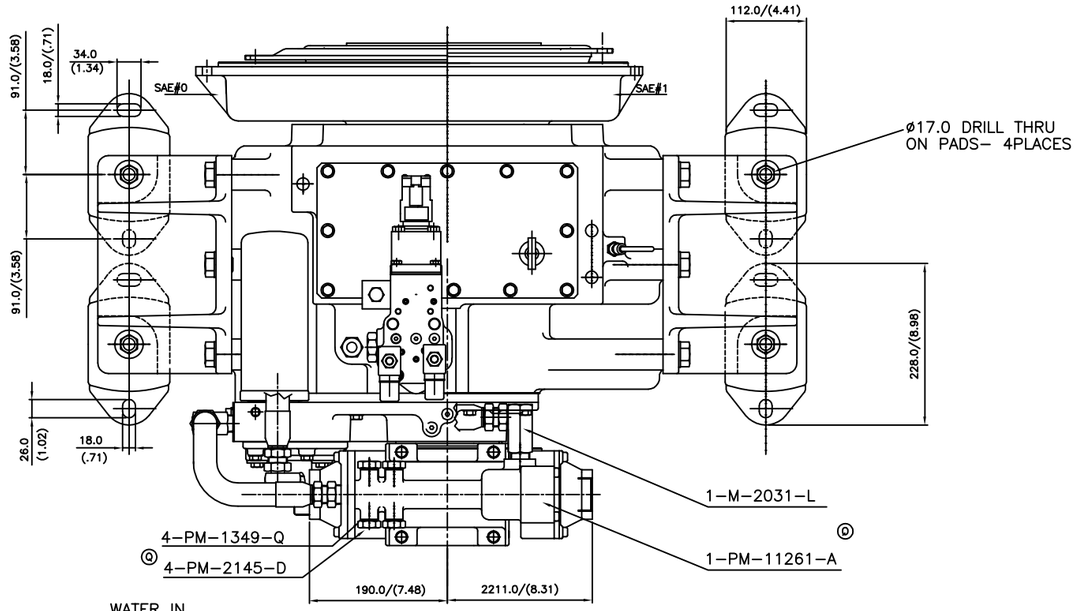
WHEN MOUNTING ENGINE/TRANSMISSION IN BOAT, ALL THE MOUNTING PADS ON THE ENGINE MUST BE USED – PLUS THE TRANSMISSION SIDE MOUNTING PADS. FAILURE TO DO SO MAY RESULT IN DAMAGE TO TRANSMISSION. SEE BELOW:

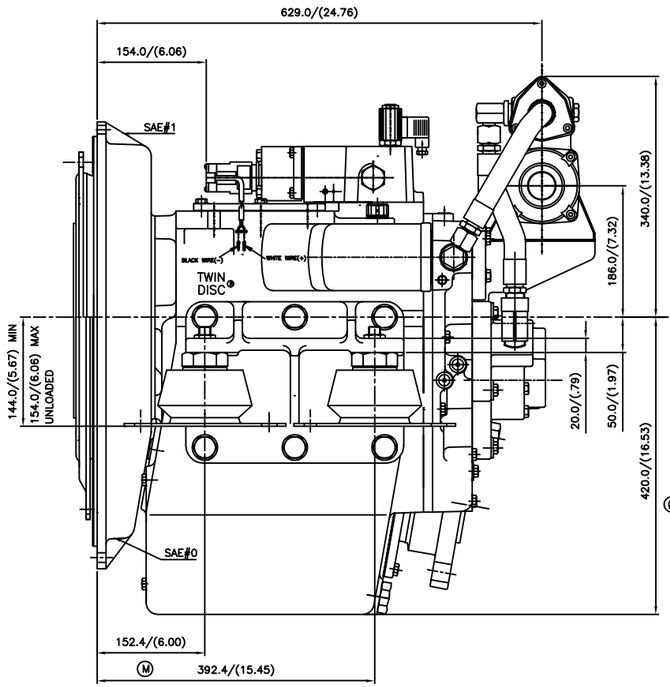
THE PX–10830 CONFIGURATION IS NOT SUITABLE FOR REMOTE MOUNTING.

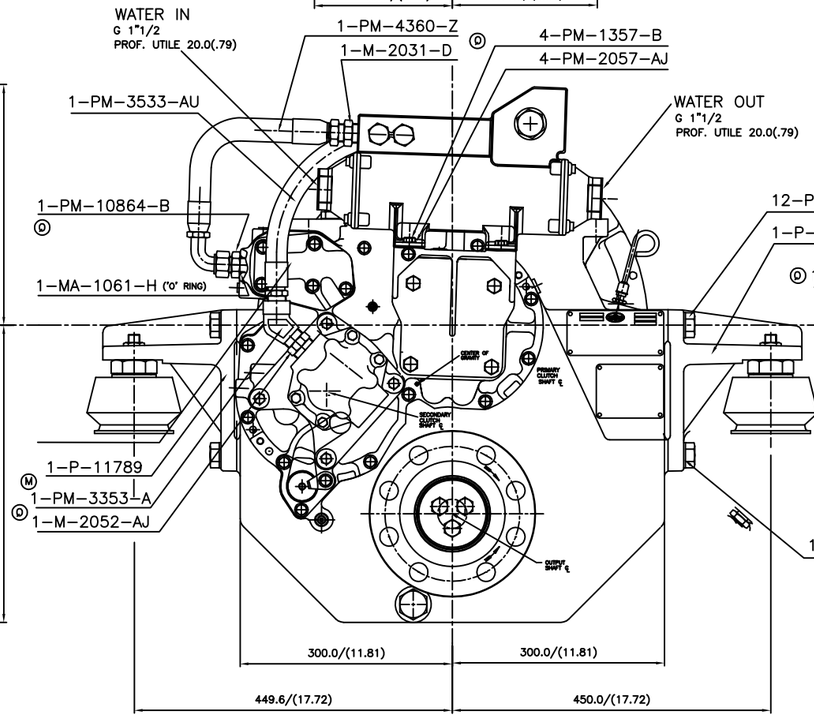


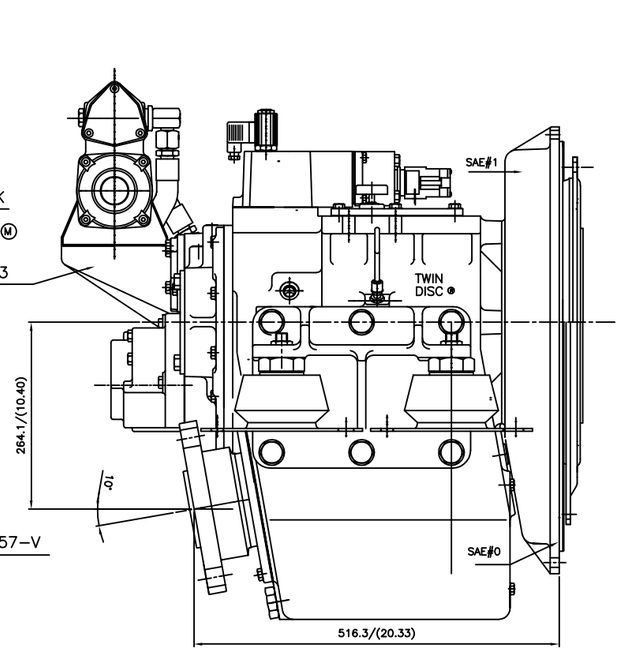
HEAT EXCHANGER (H.E.) REQUIREMENTS

REFER TO B3649 FOR HEAT EXCHANGER REQUIREMENTS









FOR OTHERS INSTALLATION DIMENSIONS
SEE DRAWING PX 10830 SHEET 2.

SCALE 0 20 40 60 mm / 0 1.0 2.0 3.0 INCH

METRIC
DIMENSIONS SHOWN IN BRACKETS ARE IN INCH.

THIRD ANGLE PROJECTION
SIMILAR TO

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MATERIAL	
HEAT TREAT	
SURFACE TREATMENT	
WEIGHT LBS.	WR² LBS. IN²
FIRST USE	
ASSY.	
MODEL	
NAME	MG5145–A MARINE TRANSMISSION (REF. PX–10830)
DATE	4DEC2000
SCALE	.25=1.00
DRN.	RZ
CHK.	VR
APPD.	PJC

TWIN DISC INCORPORATED RACINE, WI 53403 – USA

PX–10830

SHEET 4 REV I

F E D C B A

1 2 3 4 5 6

NOTE:

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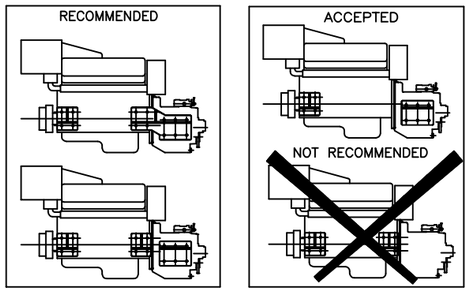
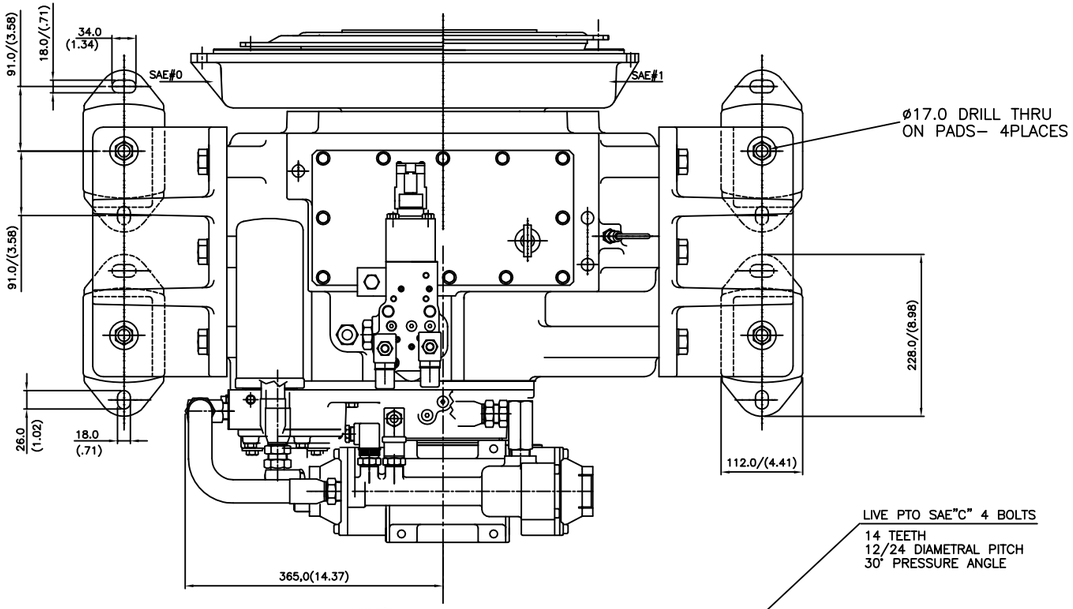
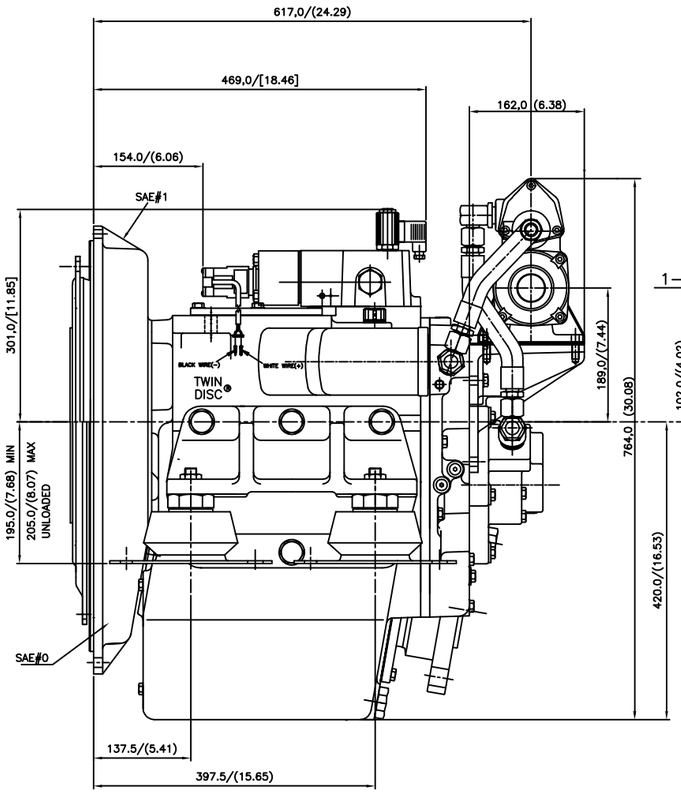
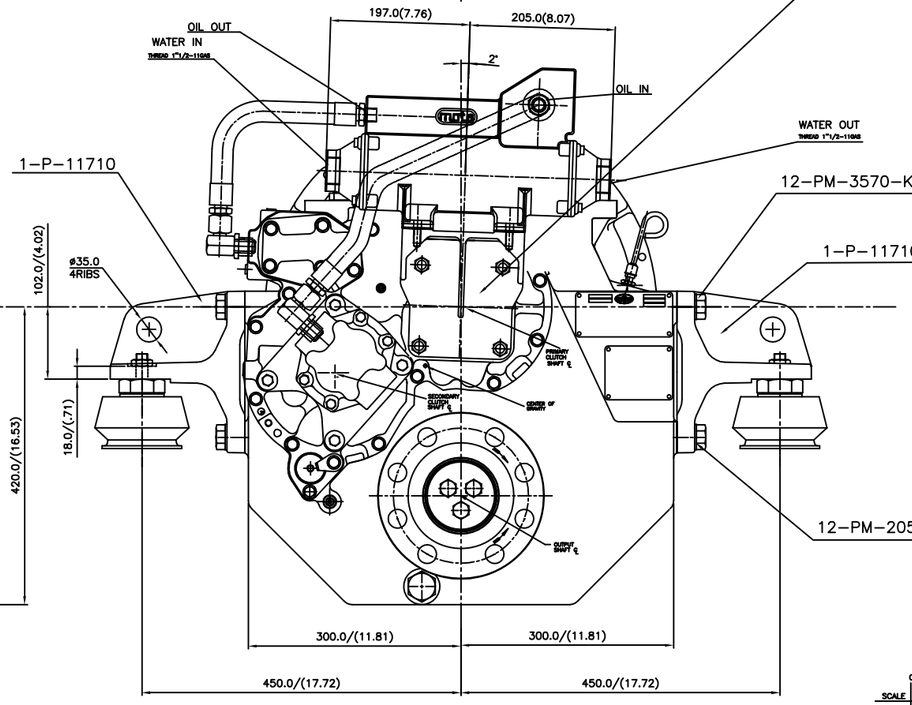
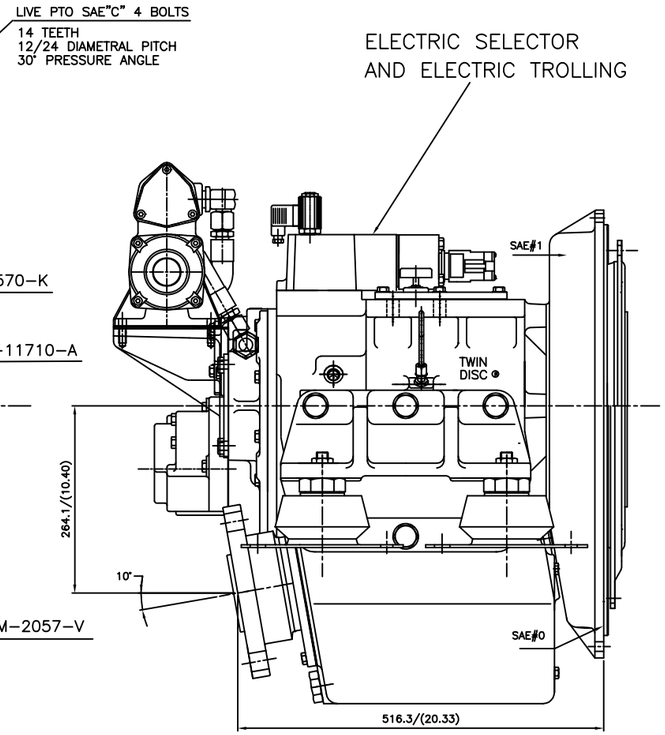


REFER TO B3649 FOR HEAT EXCHANGER REQUIREMENTS









FOR OTHERS INSTALLATION DIMENSIONS
SEE DRAWING PX 10830 SHEET 2.

ELECTRIC AND MECHANICAL VALVES SHOWN

SCALE 0 20 40 60 mm / 0 1.0 2.0 3.0 INCH

METRIC
DIMENSIONS SHOWN IN BRACKETS ARE IN INCH.

THIRD ANGLE PROJECTION
SIMILAR TO

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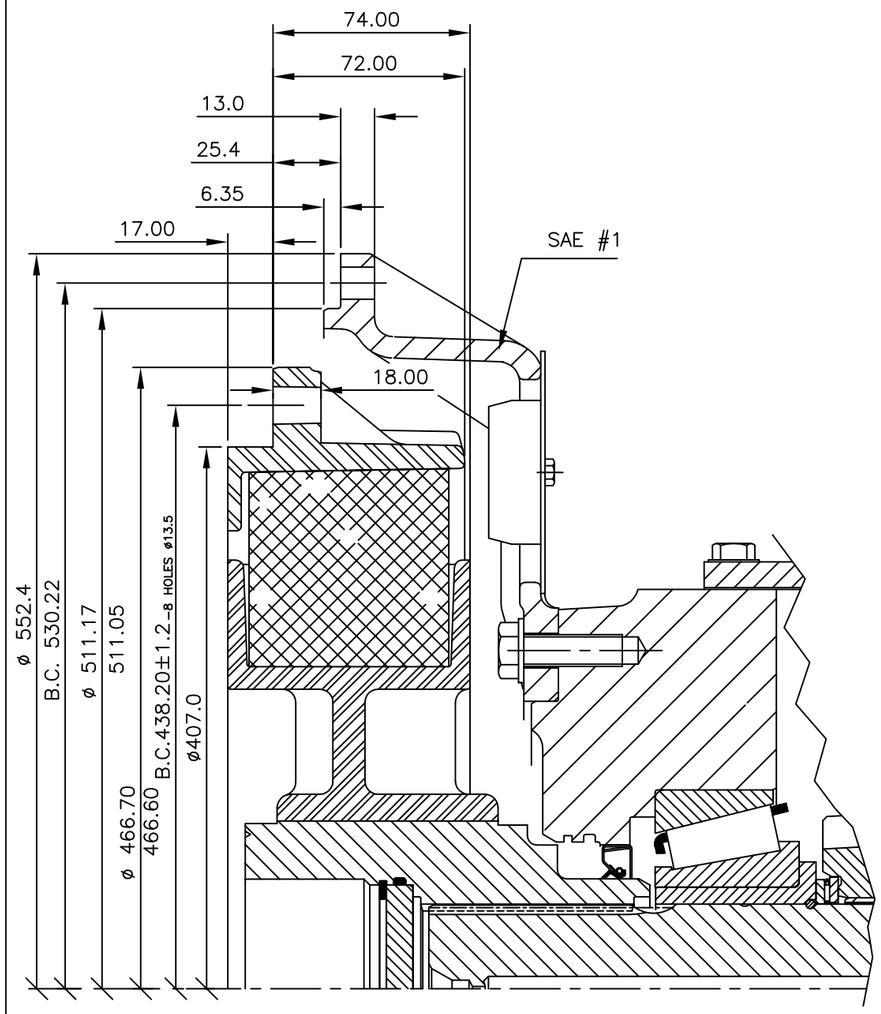
MATERIAL	WEIGHT LBS.	WR² LBS. IN²	DATE 14NOV01
HEAT TREAT	FIRST USE		SCALE .25=1.00
	ASSY.		DRN. RZ
SURFACE TREATMENT	MODEL		CHK. VR
	NAME MG5145–A MARINE TRANSMISSION (REF. PX–10830)		APPD. PJC

TWIN DISC INCORPORATED RACINE, WI 53403 – USA

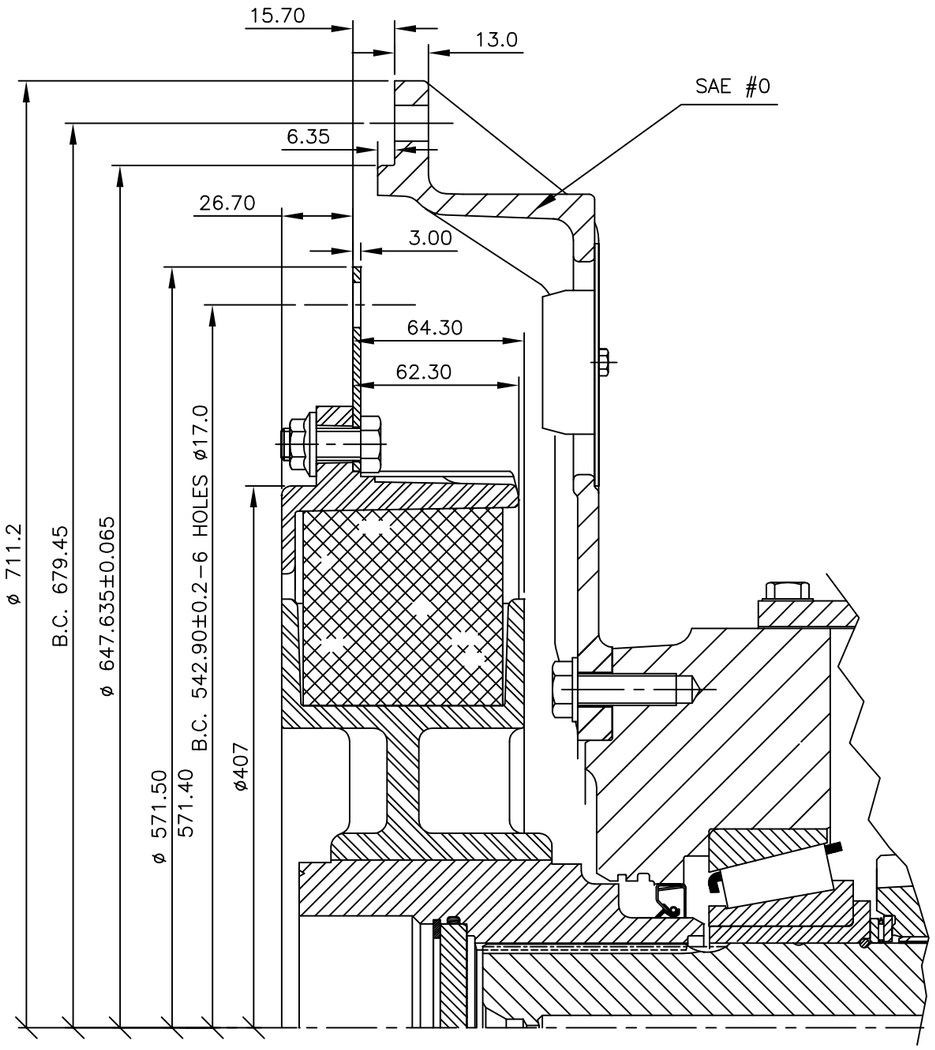
PX–10830

SHEET 5 REV _T_

COUPLING : PX–11518



COUPLING : PX–11536



COUPLING N°	CENTA DRAWING N°	NOMINAL TORQUE	DYNAMIC TORSIONAL STIFFNESS CTdyn [KNm/rad & Lbsin/rad]					WR²		MAX. COUPLING SPEED
			0.05 T kN	0.25 T kN	0.50 T kN	0.75 T kN	1.00 T kN	OUTER PARTS	INNER PARTS	
PX–11518	CENTA TYPE R 26–60422–00	6300 Nm 55686 Lbs.in	6 53023	23 203256	74 653953	115 1016278	178 1573022	0.206 Kgm² 704 Lbsin²	0.165 Kgm² 564 Lbsin²	3000 RPM
PX–11536	CENTA TYPE R 26–60423–00	6300 Nm 55686 Lbs.in	6 53023	23 203256	74 653953	115 1016278	178 1573022	0.290 Kgm² 992 Lbsin²	0.165 Kgm² 564 Lbsin²	2800 RPM

WEIGHT kg	WR² Nm²	UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE mm MACHINED DIMENSIONS X. ±0.75 X.X ±0.25 X.XX ±0.13 ALL ANGULAR TOLERANCES ±1° GEOMETRIC TOLERANCING PER ANSI Y14.5M 1982	METRIC
FIRST USE : ASSEMBLY N° : MODEL N° : MG–5145–A			
SIMILAR TO : PX10885	MATERIAL	DATE 20NOV02	TWIN DISC INCORPORATED RACINE, WI 53403 – USA
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		DRAWN RZ	PX–10830
	NAME FLEXIBLE COUPLING	CHECKED VR	
		APPROVED JCP	SHEET 6 REVISION : T FORMAT A1

NOTE:

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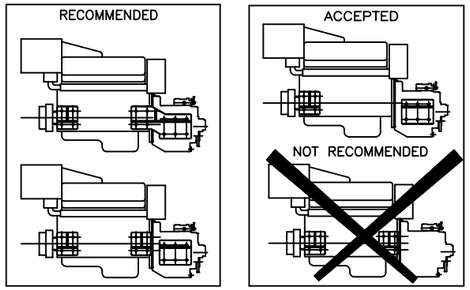
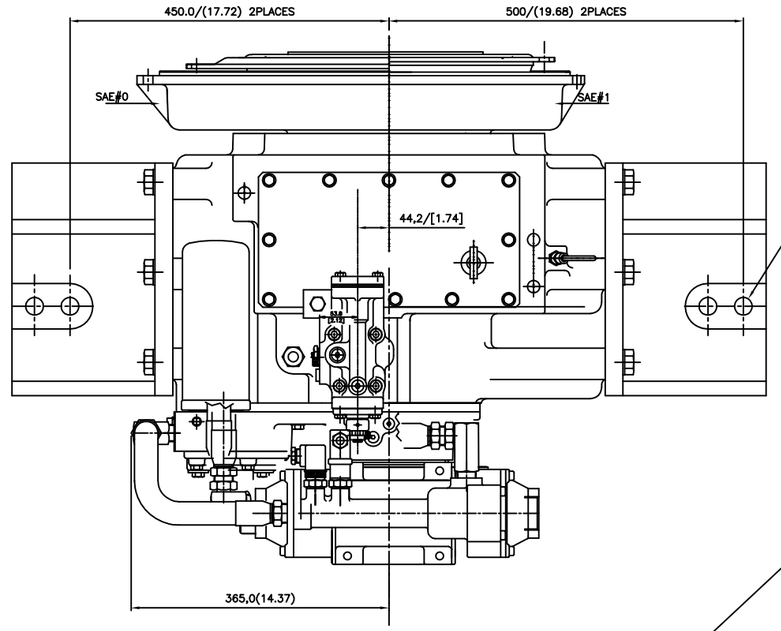
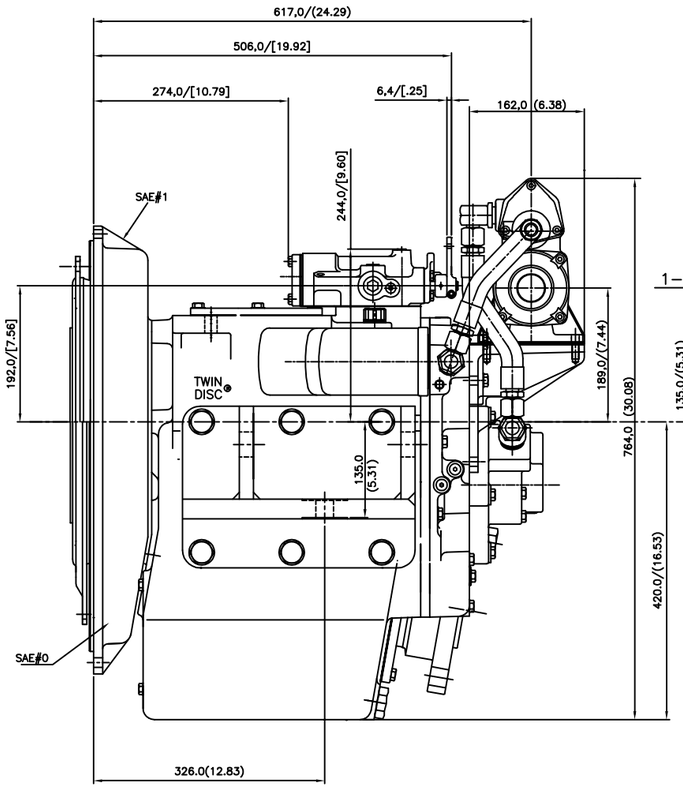
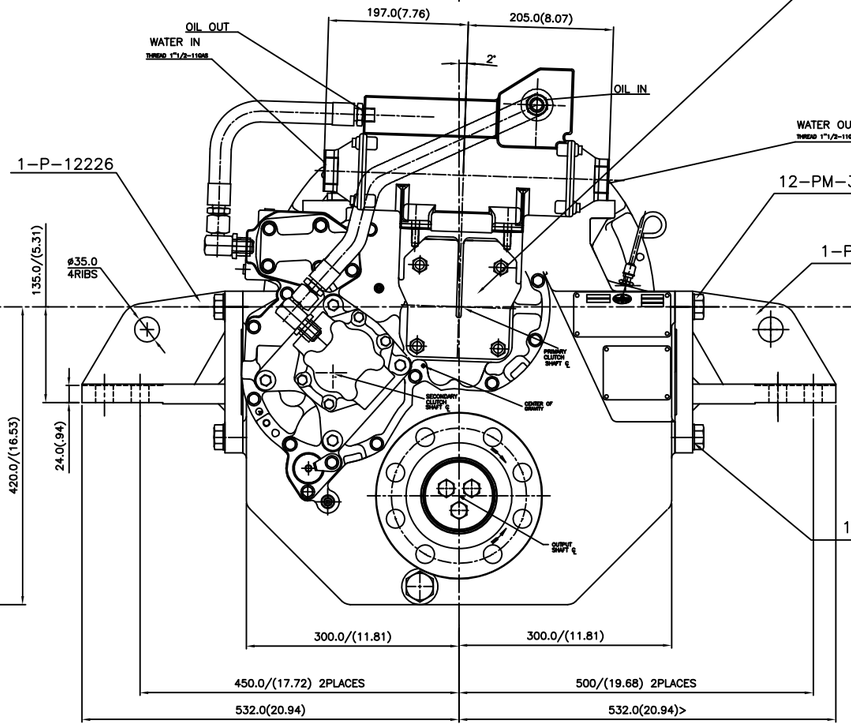
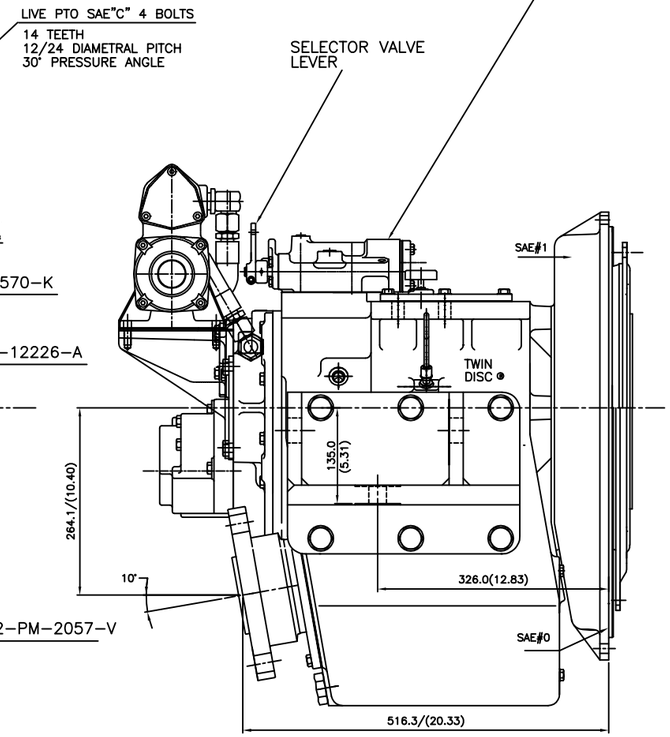


REFER TO B3649 FOR HEAT EXCHANGER REQUIREMENTS









FOR OTHERS INSTALLATION DIMENSIONS SEE DRAWING PX 10830 SHEET 2.

SCALE 0 20 40 60 mm / INCH 0 1.0 2.0 3.0

METRIC
DIMENSIONS SHOWN IN BRACKETS ARE IN INCH.

THIRD ANGLE PROJECTION
SIMILAR TO

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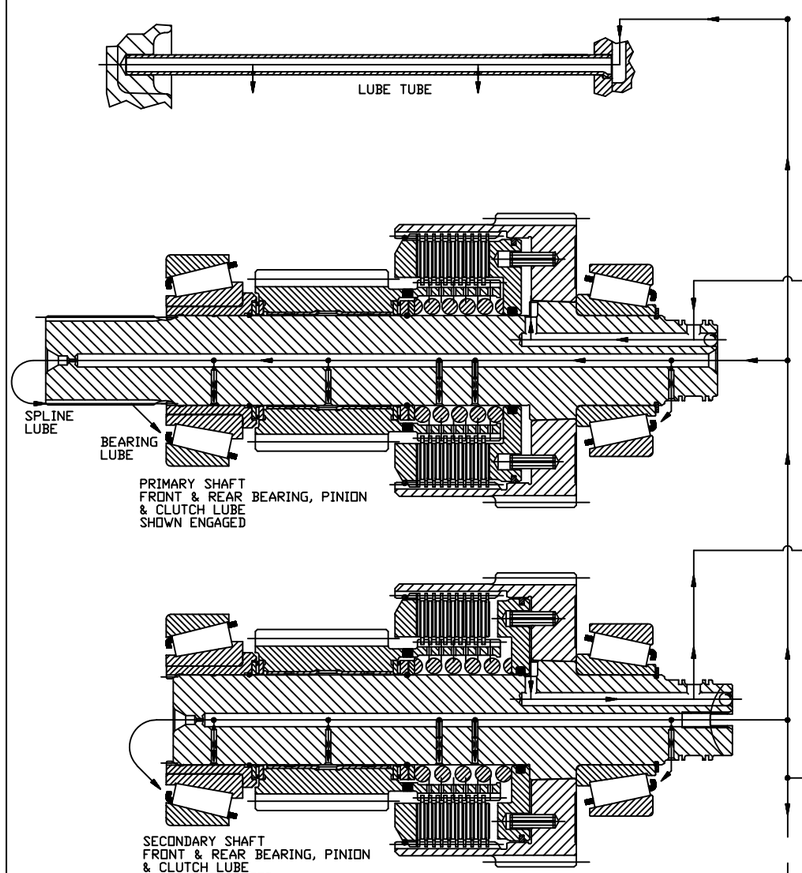
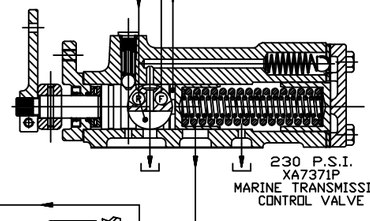
MATERIAL	WEIGHT LBS. / WR² LBS. IN²	DATE	14NOV01
HEAT TREAT	FIRST USE	SCALE	.25=1.00
	ASSY.	DRN.	RZ
SURFACE TREATMENT	MODEL	CHK.	VR
	NAME MG5145–A MARINE TRANSMISSION (REF. PX–10830)	APPD.	PJC

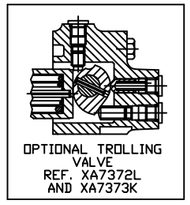
TWIN DISC INCORPORATED RACINE, WI 53403 – USA

PX–10830

SHEET 7 REV T

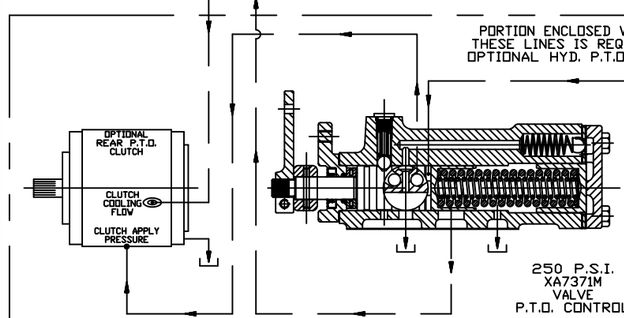

LUBE TUBE
SPLINE LUBE
BEARING LUBE
PRIMARY SHAFT FRONT & REAR BEARING, PINION & CLUTCH LUBE SHOWN ENGAGED
SECONDARY SHAFT FRONT & REAR BEARING, PINION & CLUTCH LUBE SHOWN DISENGAGED

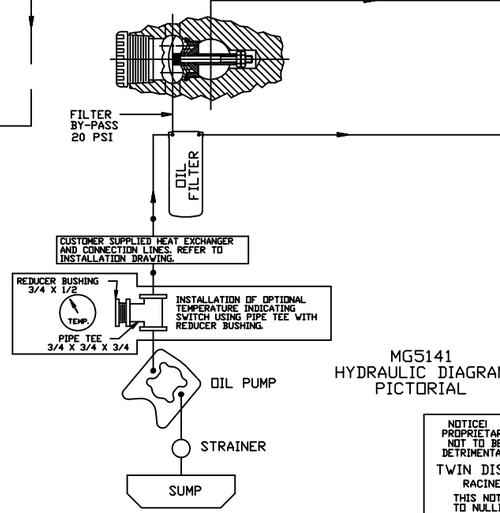




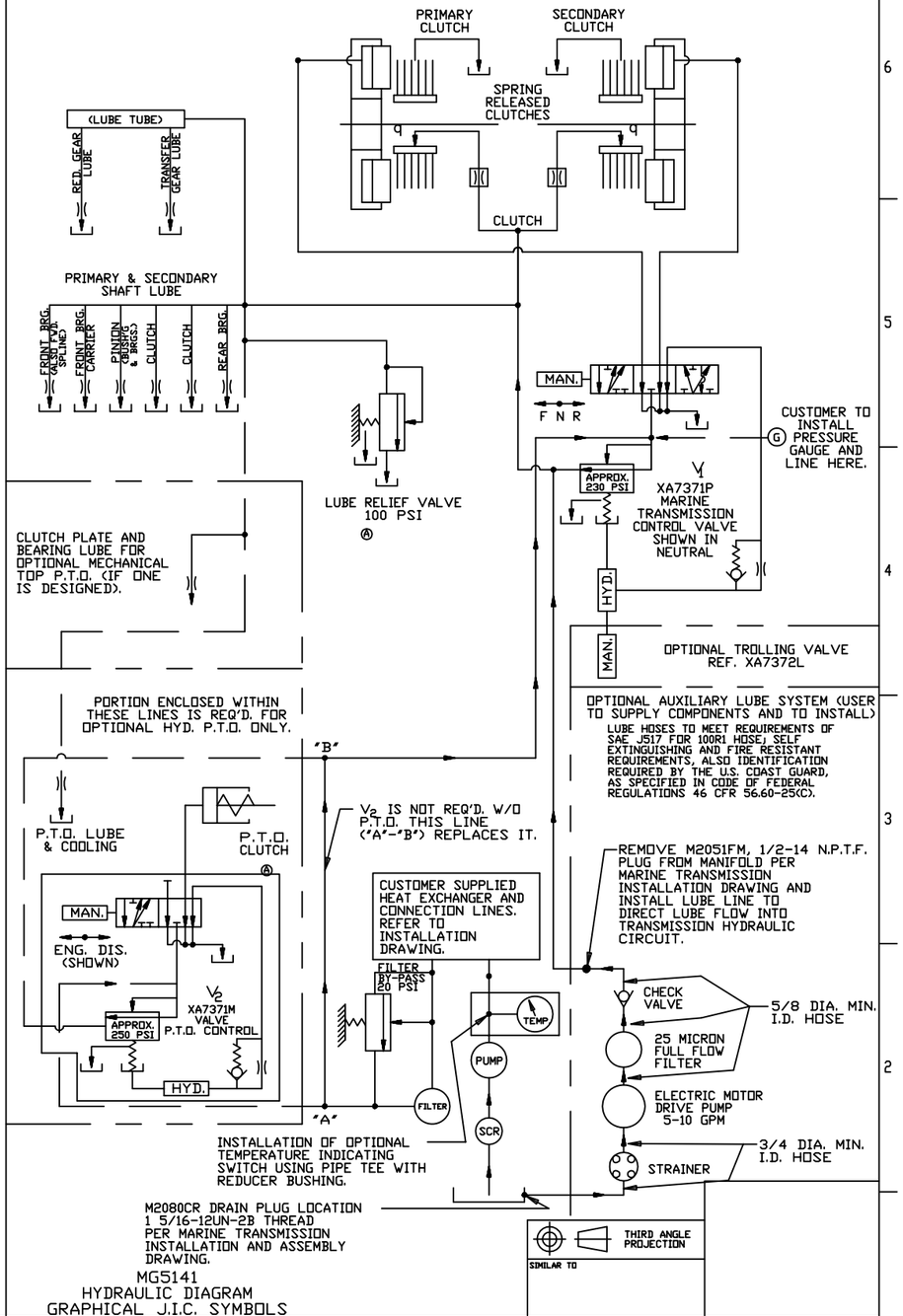
G CUSTOMER TO INSTALL PRESSURE GAUGE LINE HERE. PRESSURE GAUGE TO BE MOUNTED IN PILOT HOUSE. (SEE MARINE TRANSMISSION INSTALLATION DRAWING.)

LUBE RELIEF VALVE 100 PSI Ⓐ




FILTER BY-PASS 20 PSI
OIL FILTER
CUSTOMER SUPPLIED HEAT EXCHANGER AND CONNECTION LINES. REFER TO INSTALLATION DRAWING.
REDUCER BUSHING 3/4 X 1/2
TEMP.
PIPE TEE 3/4 X 3/4 X 3/4
INSTALLATION OF OPTIONAL TEMPERATURE INDICATING SWITCH USING PIPE TEE WITH REDUCER BUSHING.
OIL PUMP
STRAINER
SUMP

MG5141
HYDRAULIC DIAGRAM
PICTORIAL


PRIMARY CLUTCH
SECONDARY CLUTCH
SPRING RELEASED CLUTCHES
CLUTCH
(LUBE TUBE)
RED. GEAR LUBE
TRANSFER GEAR LUBE
PRIMARY & SECONDARY SHAFT LUBE
FRONT BRG. (MAIN SHAFT SPLINE)
FRONT BRG. CARRIER
PINION (BRGS. & BRGS.)
CLUTCH
CLUTCH
REAR BRG.
LUBE RELIEF VALVE 100 PSI Ⓐ
CLUTCH PLATE AND BEARING LUBE FOR OPTIONAL MECHANICAL TOP P.T.O. (IF ONE IS DESIGNED).
PORTION ENCLOSED WITHIN THESE LINES IS REQ'D. FOR OPTIONAL HYD. P.T.O. ONLY.
P.T.O. LUBE & COOLING
P.T.O. CLUTCH Ⓐ
MAN.
ENG. DIS. (SHOWN)
APPROX. 250 PSI
½ XA7371M VALVE P.T.O. CONTROL
HYD.
"B"
"A"
½ IS NOT REQ'D. W/O P.T.O. THIS LINE ("A"-"B") REPLACES IT.
CUSTOMER SUPPLIED HEAT EXCHANGER AND CONNECTION LINES. REFER TO INSTALLATION DRAWING.
FILTER BY-PASS 20 PSI
TEMP.
PUMP
FILTER
SCR
INSTALLATION OF OPTIONAL TEMPERATURE INDICATING SWITCH USING PIPE TEE WITH REDUCER BUSHING.
M2080CR DRAIN PLUG LOCATION 1 5/16-12UN-2B THREAD PER MARINE TRANSMISSION INSTALLATION AND ASSEMBLY DRAWING.
MAN.
F N R
APPROX. 230 PSI
XA7371P MARINE TRANSMISSION CONTROL VALVE SHOWN IN NEUTRAL
G CUSTOMER TO INSTALL PRESSURE GAUGE AND LINE HERE.
HYD.
MAN.
OPTIONAL TROLLING VALVE REF. XA7372L
OPTIONAL AUXILIARY LUBE SYSTEM (USER TO SUPPLY COMPONENTS AND TO INSTALL)
LUBE HOSES TO MEET REQUIREMENTS OF SAE J517 FOR 100R1 HOSE, SELF EXTINGUISHING AND FIRE RESISTANT REQUIREMENTS, ALSO IDENTIFICATION REQUIRED BY THE U.S. COAST GUARD, AS SPECIFIED IN CODE OF FEDERAL REGULATIONS 46 CFR 56.60-25(C).
REMOVE M2051FM, 1/2-14 N.P.T.F. PLUG FROM MANIFOLD PER MARINE TRANSMISSION INSTALLATION DRAWING AND INSTALL LUBE LINE TO DIRECT LUBE FLOW INTO TRANSMISSION HYDRAULIC CIRCUIT.
CHECK VALVE
5/8 DIA. MIN. I.D. HOSE
25 MICRON FULL FLOW FILTER
ELECTRIC MOTOR DRIVE PUMP 5-10 GPM
3/4 DIA. MIN. I.D. HOSE
STRAINER

MG5141
HYDRAULIC DIAGRAM
GRAPHICAL J.I.C. SYMBOLS

THIRD ANGLE PROJECTION

SIMILAR TO

REV	ZONE	CH. NO.	DATE	REV	ZONE	CH. NO.	DATE
A	D-3 B-4	29090	1-25-99				

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MATERIAL

HEAT TREAT

SURFACE TREATMENT

WEIGHT LBS. | WR² LBS. IN²

FIRST USE
ASSY. 1003728
MODEL MG5141

NAME DIAGRAM, HYDRAULIC

UNLESS OTHERWISE SPECIFIED
MACHINED DIMENSIONS
XX ±0.030
XXX ±0.010
XXXX ±0.005
ALL ANGULAR TOLERANCES ±1°
GEOMETRIC TOLERANCING PER ANSI Y14.5M 1982

DATE 8-16-90
SCALE NONE
DRN. KS
CHK. DAS
APPD. TBC

TWIN DISC INCORPORATED RACINE, WI 53403 - USA

A7119M

SHEET 1 OF 1 REV A

F E D C B A

P.T.O ASSEMBLY TO MARINE TRANSMISSION–(FACTORY AND FIELD INSTALLATION) :

1.FOR FACTORY INSTALLATION: THE PARTS (⧫) A2916BE RING"O"(1);PM1996F SCREWS(4); 202347 COVER(1);MA1038A (2)ON MANIFOLD; MUST BE OMITTED.

FOR FIELD INSTALLATION:THE ABOVE PARTS (⧫) MUST BE REMOVED .

2. CLEAN MATING SURFACE (INPUT END) OF P–11611 P.T.O. HOUSING.

3. INSTALL 2–PM–4049A DOWEL PINS INTO MANIFOLD (AT MATING FACE NEAR REAR END OF PRIMARY SHAFT(FW'D.SHAFT). CHAMFERED END OF PINS SHOULD BOTTOM IN HOUSING HOLES.

4. INSTALL B3642 P.T.O. HOUSING GASKET OVER 2–PM–4049A DOWEL PINS AND ENSURE THAT THIS GASKET IS FLAT AGAINST THE MANIFOLD FACE.

5. INSTALL 2–A2711AU DOWEL PINS PROVIDED INTO REAR END OF PRIMARY SHAFT (FW'D SHAFT): CHAMFERED END OF PINS SHOULD BOTTOM IN SHAFT HOLES.

6. ATTACH AN AIR HOSE TO CLUTCH HOUSING(PX–11611) (HOLE IS TAPPED FOR M10X1.0(ISO–6149"O"–RING FITTING) TO DELIVER AND HOLD 89.6 KPA(13 PSI) MINIMUM TO CLUTCH DURING ASSEMBLY.

7. STAND P.T.O ON ITS FACE " E"(OUTPUT) END. LOOKING DOWN INTO CLUTCH PACK, ALIGN TEETH OF DRIVING PLATES BY EYE AND CAREFULLY SLIDE P–11601 DRIVING RING INTO P.T.O. HOUSING SO THAT IT ENGAGES THE TEETH OF ALL DRIVING PLATES AND BOTTOMS AGAINST THE INSIDE OF THE HOUSING.

8. APPLY AIR PRESSURE 89.6 KPA(13PSI) MIN. TO CLUTCH HOUSING(PX–11611) AND MAINTAIN PRESSURE,THIS LOCKS PLATES IN PROPER ALIGNMENT FOR ASSEMBLY. SLIDE DRIVING RING OUT OF P.T.O. HOUSING.

9. ASSEMBLE M1904AQ PISTON RING INTO GROOVE OF DRIVING (IF NOT ALREADY DONE).

10. ASSEMBLE DRIVING RING TO REAR END OF PRIMARY SHAFT(FW'D.SHAFT) BY SLIDING DRIVING RING ONTO DOWEL PINS AND PUSHING CAREFULLY FORWARD INTO SHAFT BORE AND AGAINST PRIMARY SHAFT(FW'D.SHAFT).FASTEN USING 2–PM–1180G SCREWS PROVIDED AND TORQUE PER S574 OR TO SERVICE MANUAL VALUES.

11. SLIDE P.T.O. ASSEMBLY,STILL AIR PRESSURIZED,CAREFULLY FORWARD OVER DRIVING RING SO THAT RING ENGAGES THE TEETH OF THE CLUTCH PLATES. P.T.O. ASS'Y. MAY NEED TO BE ROTATED SLIGHTLY IN EITHER DIRECTION TO ENGAGE THE PLATE TEETH. IF P.T.O. DOES NOT LINE UP WITH DOWEL PINS,ENGINE MUST BE HAND–TURNED UNTIL P.T.O. DOES LINE UP. DO NOT RELEASE AIR PRESSURE TO CLUTCH PACK. SECURE P.T.O. WITH 4–MA996–S CAP SCREWS, OR THE 4–PM–1369–Y STUDS AND 4–PM–1399J NUTS PROVIDED, AND TORQUE PER S574 OR TO SERVICE MANUAL VALUES.

12. AIR PRESSURE MAY NOW BE RELEASED. DISCONNECT AIR LINE AND FITTINGS FROM CLUTCH HOUSING(PX–11611).

13. ASSEMBLE BODY ASS'Y PX–11610 ON CLUTCH HOUSING,SECURE WITH 5–PM–3254B CAPSCREWS & TORQUE PER S–574A OR TO SERVICE MANUAL VALUES.

14. ASSEMBLE CLUTCH ENGAGING PRESSURE FITTINGS FROM THE BODY VALVE(PX–11610) TO THE CONTROL VALVE AND HEAT EXCHANGER.

SECTION : "B–B"

HYDRAULIC P.T.O. SHAFT DRIVE PX–11615

HYDRAULIC P.T.O. PUMP DRIVE PX–11615–A

TWIN DISC ©

CONTROL VALVE

PRIMARY CLUTCH SHAFT ℄

SECONDARY CLUTCH SHAFT ℄

OUTLET TO FILTER (1)

INLET FROM H.E. (2)

INLET FROM EXTERNAL H.E. (NOT SUPPLIED)

OUTLET TO VALVE(2)

INLET TO FILTER(1)

WATER IN

WATER OUT

P.T.O. CLUTCH PRESSURE

FACE"E"

PUMP SPLINE DATA
FLAT ROOT
14 TEETH
12/24 PITCH
30° PRESS.ANGLE
1.167 PITCH.DIA.

S.A.E. J744 SIZE" C" PUMP MOUNT: FOUR(4)M12x1.75 THREADED STUDS WITH NUTS,EQUALLY SPACED ON 161.92(6.375)DIA. (BASIC)H.C.

PTO. OIL DRAIN TO MARINE TRANSMISSION SUMP

SAE#0

PX11610	1	
P11610	1	
M1990C	2	
M1990E	1	
1020152	1	
MA1038–F	1	
PM–11139	1	
PM–4360AB	1	
PM3533–BQ	1	*
PM2523–N	2	
MA1053–D	2	
PM1349–AE	2	
PM11613	1	
PM–3254H	1	
PM–3254B	4	
M20518H	1	
MA–1038A	1	
PX–11602	1	
P–11602	1	
M1945BV	1	
M1945AJ	12	
M2078M	1	
M2033X	1	12.7x12.7x95.2 KEY. (.50x.50x3.75)
MA983	1	
M2693J	1	
P–11612	1	
B3628	1	
MA996–S	4	
PM–2057Z	4	
XA2701BH	12	
A2701BH	1	
A2700AM	1	
B2506	12	
*PM2261–D	1	
PM–11261A	1	**
PM–2057–AJ	4	
PM–1357–B	4	
PM–2805G	1	
P–11607	1	●
PM4330U	2	● ©
PM–10864B	1	
A2012–A	1	
M422	2	
A2916–AJ	2	
PM2261–D	1	
M2031–D	1	*
M201411–A	1	●
PM–11608	1	●
A2903AU	1	●
M1945T	1	●
PM3533–AU	1	*
PM–1180G	2	
A2711AU	2	
PM–4049A DOWEL PIN	2	
P–11611	1	
PM–1369Y	4	●
PM–1399J	4	●
PX–11581	1	●
P–11581	1	●
M1841AK	1	●
M–2031–L	1	*
M–2052–AJ	1	*
M–2988–J	1	**

SYM.	CH. NO.	DATE	SYM.	CH. NO.	DATE
C	6856	15APR03			
B	6819	20FEB03			
A	6537	31JAN02			

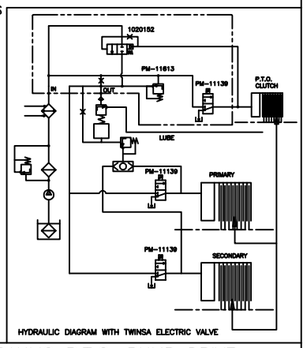
ASSEMBLY INSTRUCTIONS

▼ IMPORTANT :
IF CLUTCH STARTS TO TURN IN NEUTRAL AT OPERATING TEMPERATURE,BRAKE PLATE IS PROBABLY WORN. REPLACE IT AND SERVICE CLUTCH AS REQUIRED TO ELIMINATE TURNING IN NEUTRAL BEFORE FURTHER OPERATION.

UNMARKED PARTS COMMON TO BOTH DRIVE TYPE P.T.O'.S.
○ DENOTES PARTS FOR SHAFT DRIVE HYDRAULIC P.T.O.(ONLY, PX–11615)
● DENOTES PARTS FOR PUMP DRIVE HYDRAULIC P.T.O.(ONLY, PX–11615–A)

IMPORTANT :
FOR INSTALLATIONS DRAWING WITH HEAT EXCHANGER SEE : PX–11380(SHEET 2) AND FOR OTHER DIMENSIONS SEE PX–11380 (SHEET 2)
NOTE :
ALL POINTS AVAILABLE FOR TESTING ARE CODED ⬡ .

*OPTION WITH HEAT EXCHANGER ON UNIT.
**OPTION LESS HEAT EXCHANGER ON UNIT.



HYDRAULIC DIAGRAM WITH TWINSA ELECTRIC VALVE

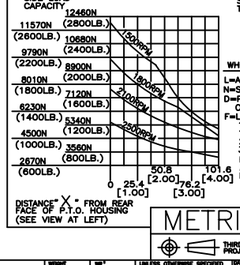
HYDRAULIC P.T.O. PUMP DRIVE SPECIFICATIONS:

HORSEPOWER RATING : 162HP AT 1800 R.P.M.
MAX.P.T.O. WORKING TORQUE : 641Nm(473 LB.FT.)
MAX.P.T.O. OPERATING SPEED : 2500 R.P.M.
RECOMMENDED MAX.ENGINE SPEED WHEN ENGAGING CLUTCH: .5x MATCH POINT SPEED.
P.T.O SHAFT ROTATION SAME AS ENGINE ROTATION.
P.T.O. CAN BE USED WITH R.H. OR L.H. ROTATION ENGINES.
P.T.O. ACCEPTS S.A.E. J744 SIZE" C" PUMP.

HYDRAULIC P.T.O. SHAFT DRIVE SPECIFICATIONS:

HORSEPOWER RATING : 162HP AT 1800 R.P.M.
MAX.P.T.O. WORKING TORQUE : 641Nm(473 LB.FT.)
MAX.P.T.O. OPERATING SPEED : 2500 R.P.M.
RECOMMENDED MAX.ENGINE SPEED WHEN ENGAGING CLUTCH: .5x MATCH POINT SPEED.
P.T.O SHAFT ROTATION SAME AS ENGINE ROTATION.
P.T.O. CAN BE USED WITH R.H. ROTATION ENGINES. ONLY.
BACKDRIVING OF P.T.O. IS NOT PERMITTED.
MAX.EXTERNAL THRUST LOAD ON P.T.O. SHAFT IN EITHER DIRECTION=.5xSIDE LOAD CAPACITY (WITH NO SIDE LOAD ON P.T.O. SHAFT)

"L" MAX. P.T.O. SIDE LOAD :



THE FOLLOWING GENERAL FORMULA SHOULD BE USED FOR DETERMINING THE ACTUAL APPLIED LOAD:

L = 126,000xHP xF / NxD (in LBS)

L = 560.67xHP xF / NxD (in N)

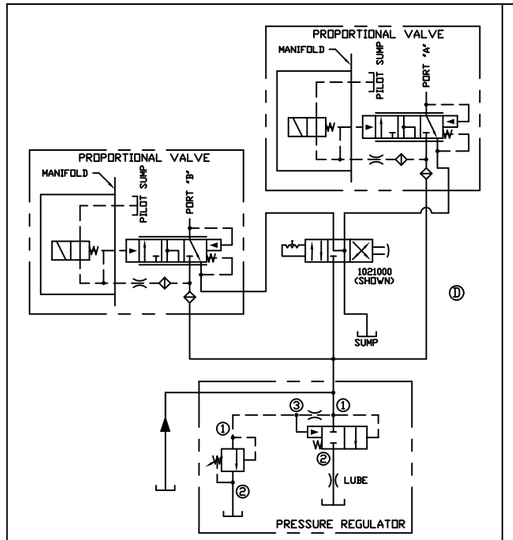
WHERE :
L=ACTUAL APPLIED LOAD(N OR LBS)
N=SHAFT SPEED(RPM)
D=PITCH DIA.(mm OR in.) OF SHEAVE,ETC.
F=LOAD FACTOR
1.0 FOR CHAIN OR GEAR DRIVE.
1.5 FOR TIMING BELTS.
2.5 FOR ALL V BELTS.
3.5 FOR FLAT BELTS.
FOR RECIPROCATING COMPRESSORS AND OTHER SEVERE SHOCK DRIVES, MULTIPLY ABOVE FACTORS BY 2.1

METRIC
THIRD ANGLE PROJECTION

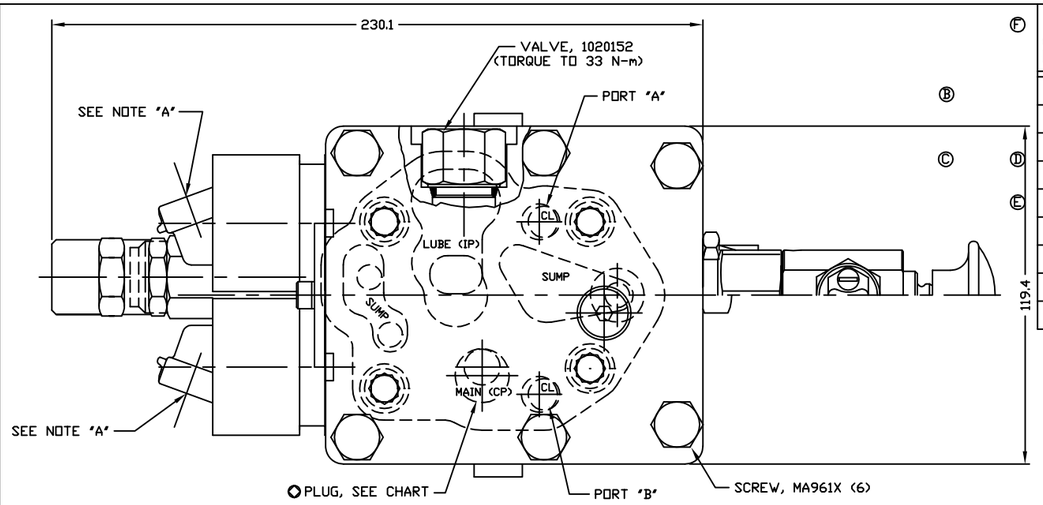
SIMILAR TO :	MATERIAL	WEIGHT kg / Nm	UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE mm / MACHINED DIMENSIONS .X ±0.5 / .XX ±0.13 / .XXX ±0.13 / ALL ANGULAR TOLERANCES ±1° / GENERAL TOLERANCES PER ANSI Y14.5M 1982
NOTICE: THIS ITEM CONTAINS INFORMATION PROPRIETARY TO TWIN DISC, INCORPORATED RACINE, WI 53403 — USA. IT IS LOANED SUBJECT TO RETURN ON DEMAND AND WITH THE UNDERSTANDING THAT IT WILL NOT BE COPIED OR USED IN THE DESIGN OR MANUFACTURE OF PARTS OR EQUIPMENT EXCEPT BY AGREEMENT.	HEAT TREAT	FIRST USE : ASSEMBLY N°: PX–11380 / MODEL N° MG5135–A/SC	
	SURFACE TREATMENT	TITLE: POWER TAKE OFF ASS'Y.	DWG NO. 13AU001 / SCALE 1/2 / DRAWN RZ / CHECKED VR / APPROVED JCP / SHEET 1/1 / REVISION : C / FORMAT A1

TWIN DISC INCORPORATED RACINE, WI 53403 – USA

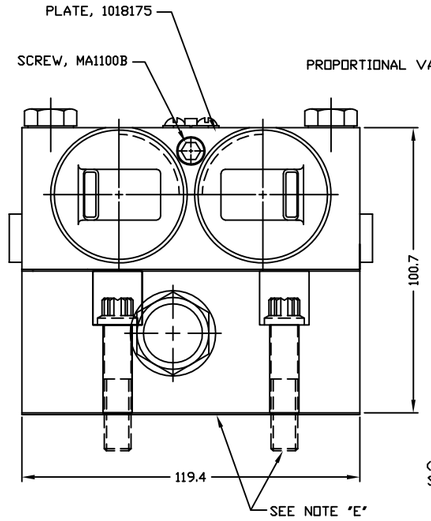
PX–11615;–A

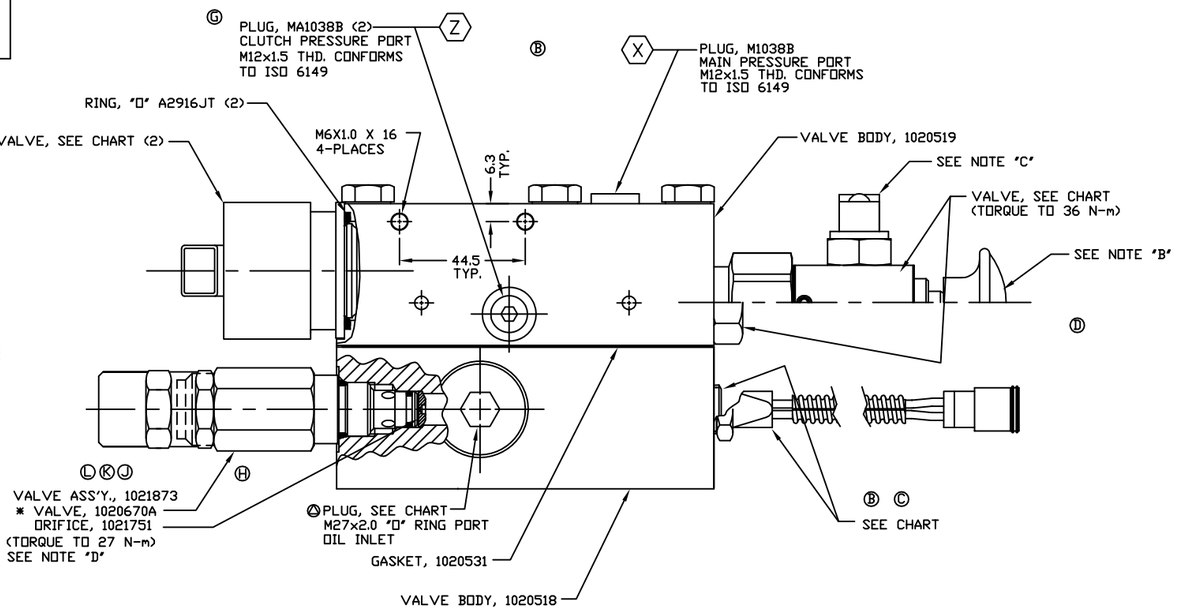


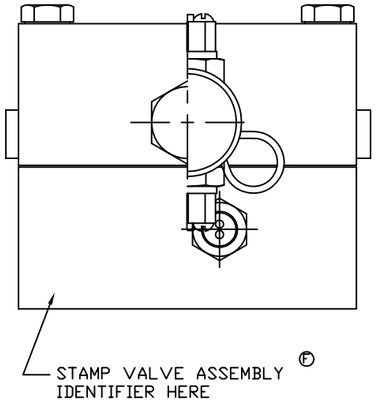
HYDRAULIC DIAGRAM (GRAPHIC SYMBOLS)



VALVE ASSEMBLY PART NO.	BOM	VALVE ASSEMBLY IDENTIFIER	VALVE Ⓛ	SENSOR	◇ PLUG	△ PLUG	CORE PLUG SEE NOTE 'F'	PROPORTIONAL VALVE (PSI)
1020729A	42223	A	1021000A	1016122A	NONE	MA1038E	NONE	1020520 (350)
1020729B	42426	B	1021000A	1016122A	NONE	MA1038E	NONE	1018528 (250)
1020729C	42127	C	1021000A	NONE	M2051S	MA1038E	NONE	1018528 (250)
1020729D	42126	D	1021000A	NONE	M2051S	MA1038E	NONE	1020520 (350)
1020729E	42516	E	1020542	NONE	M2051S	MA1038E	M1945E PORT 'A'	1018528 (250)
1020729F	42974	F	1021000A	NONE	M2051S	MA11185A	NONE	1018528 (250)







NOTES :

A. PROPORTIONAL CONTROL VALVE OPERATION
   1. WARNING DO NOT CONNECT VALVE COIL DIRECTLY TO BATTTERY/POWER SUPPLY VOLATAGE.
   2. OPERATION TO BE PERFORMED WITH ONLY TWIN DISC CONTROL SYSTEMS OR MODULES.

B. MANUAL DIRECTIONAL CONTROL VALVE OPERATION
   1. WITH MANUAL DIRECTIONAL CONTROL VALVE IN CENTERED POSITION, PUSH TO ENGAGE PORT 'A'
   2. WITH MANUAL DIRECTIONAL CONTROL VALVE IN CENTERED POSITION, PULL TO ENGAGE PORT 'B'

C. MANUAL DIRECTIONAL CONTROL VALVE MODE SWITCH
   1. SWITCHES ARE NORMALLY CLOSED WHEN MANUAL DIRECTIONAL CONTROL VALVE IS IN THE CENTERED POSITION AND OPEN WHEN LEVER IS ACTUATED FROM CENTERED POSITION
   2. CURRENT = 20 AMPS MAX.
   3. FOR WIRING SCHEMATIC, REFER TO CONTROL MODULE DRAWING.

D. PRESSURE REGULATOR INITIAL ADJUSTMENT PROCEDURE
   1. WITH NO OIL FLOW TO VALVE, TURN ADJUSTMENT STEM OF THE 1020670A VALVE COUNTER-CLOCKWISE UNTIL REACHING POSITIVE STOP.
   2. WITH A MINIMUM OF 1 gpm, ALLOW OIL TO FLUSH PRESSURE RGEULATOR.
   3. AFTER FLUSHING, TURN ADJUSTMENT STEM OF THE 1020670A VALVE CLOCKWISE UNTIL REACHING REQURIED PRESSURE SPCIFIED IN MARINE TRANSMISSION PRODUCTION TEST SPECIFICATION.
   4. LOCK ADJUSTMENT STEM IN PLACE USING JAM NUT AND CAP.

E. REFER TO MARINE TRANSMISSION ASSEMBLY DRAWING OR BILL OF MATERIAL FOR VALVE MOUNTING GASKET AND SCREWS.

F. APPLY ANAEROBIC SEALANT MEETING M2828 REQUIREMENTS AROUND CORE PLUG, JUST BEFORE FINAL ASSEMBLY. REFER TO S774 FOR FURTHER INFORMATION.

Ⓑ REVISED AND REDRAWN - SUPERSEDES 1020729 DATED 8-9-02

* NOT SERVICEABLE SEPARATELY

REV	SHEET	ZONE	CH. NO.	DATE	REV	SHEET	ZONE	CH. NO.	DATE
		B6 E2	ECN12457	5-28-04	F		B6	ECN11978	11-18-03
L		E2	ECN12413	5-7-04	E		B6	ECN11761	8-14-03
K		E2	ECN12314	3-24-04	D			ECN11703	7-30-03
J		E3	ECN12058	12-18-03	C			ECN11529	5-2-03
H		E4	ECN12015	12-03-03	B			ECN11368	4-08-03
G					A			ECN11321	1-30-03

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MATERIAL

HEAT TREAT

SURFACE TREATMENT

WEIGHT kg | wt* N·m*

FIRST USE ASSY.

MODEL MGX-5114A

NAME VALVE ASSEMBLY

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE mm
MACHINED DIMENSIONS
X ±0.75
XX ±0.25
XXX ±0.13
ALL ANGULAR TOLERANCES ±1°
GEOMETRIC TOLERANCING PER ANSI Y14.5M 1982

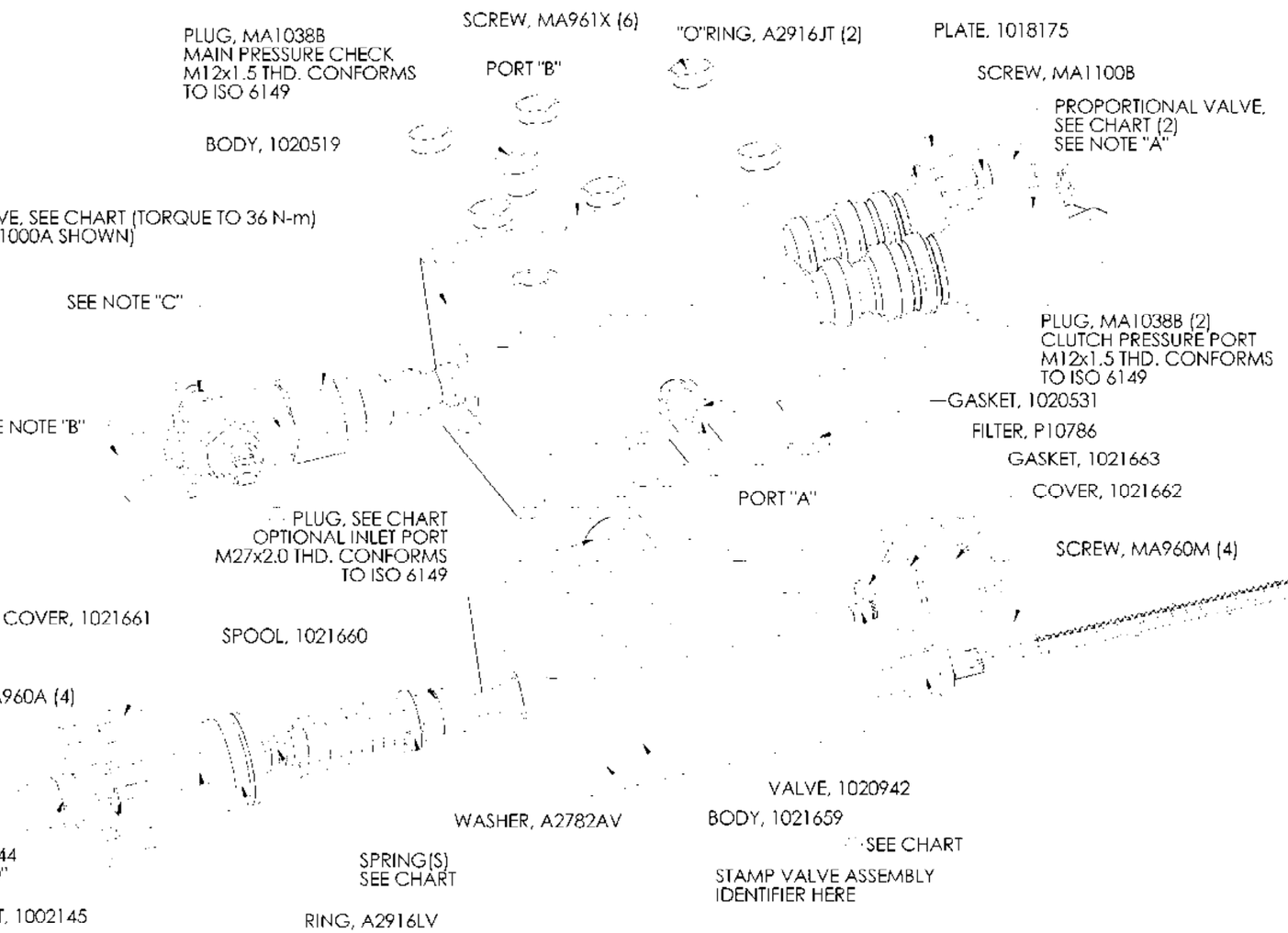
DATE 8-9-02
SCALE 1 : 1
DRN. D. MEYERS
CHK. ALC
APPD. GAM

METRIC
THIRD ANGLE PROJECTION
SIMILAR TO 1020525

TWIN DISC INCORPORATED RACINE, WI 53403 - USA

1020729 SERIES

SHEET 1 OF 1 | REV L



NOTES:

A. PROPORTIONAL CONTROL VALVE OPERATION.
   1. WARNING DO NOT CONNECT VALVE COIL DIRECTLY TO BATTERY/POWER SUPPLY VOLTAGE.
   2. OPERATION TO BE PERFORMED WITH ONLY TWIN DISC CONTROL SYSTEMS OR MODULES.

B. MANUAL DIRECTIONAL CONTROL VALVE OPERATION.
   1. WITH MANUAL DIRECTIONAL CONTROL VALVE IN CENTERED POSITION, PUSH TO ENGAGE PORT "A".
   2. WITH MANUAL DIRECTIONAL CONTROL VALVE IN CENTERED POSITION, PULL TO ENGAGE PORT "B".

C. MANUAL DIRECTIONAL CONTROL VALVE MODE SWITCH.
   1. SWITCH IS NORMALLY CLOSED WHEN MANUAL DIRECTIONAL CONTROL VALVE IS IN THE CENTERED POSITION AND OPEN WHEN LEVER IS ACTUATED FROM CENTERED POSITION.
   2. CURRENT = 20 AMPS MAX.
   3. FOR WIRING SCHEMATIC, REFER TO CONTROL MODULE DRAWING.

D. PRESSURE REGULATOR ADJUSTMENT.
   1. REMOVE 1002144 CAP AND LOOSEN 1002145 NUT.
   2. CLOCKWISE ROTATION OF 1020939A PISTON INCREASES PRESSURE. COUNTER CLOCKWISE DECREASES PRESSURE.
   3. LOCK PISTON IN PLACE USING JAM NUT AND REPLACE CAP.

E. REFER TO MARINE TRANSMISSION ASSEMBLY DRAWING OR BILL OF MATERIAL FOR VALVE MOUNTING AND SCREWS.

F. APPLY ANAEROBIC SEALANT MEETING M2828 REQUIREMENTS AROUND CORE PLUG, JUST BEFORE FINAL ASSEMBLY. REFER TO S774 FOR FURTHER INFORMATION.

G. MODIFICATION KIT TO UPGRADE EXISTING 1020729/1020696 SERIES VALVE ASSEMBLIES TO 1021658 SERIES VALVE ASSEMBLY.

VALVE ASSEMBLY PART NO.	VALVE ASSEMBLY IDENTIFIER	BOM	PRESSURE kPa (psi)	SPRING(S)	VALVE	SENSOR	PLUG	PLUG	CORE PLUG SEE NOTE "F"	PROPORTIONAL VALVE	MODIFICATION KIT SEE NOTE "G"
1021658A	A	43110	1795-2205 (260-320)	20134126 20134128	1021000A	NONE	M2051S	MA1038E	NONE	1020520	K1417
1021658B	B	43111	1585-1795 (230-260)	20134126	1021000A	NONE	M2051S	MA1038E	NONE	1018528	K1418
1021658C	C	43112	2205-2760 (320-400)	20134126 20134128	1021000A	NONE	M2051S	MA1038E	NONE	1020520	K1420
1021658D	D	43195	1795-2205 (260-320)	20134127 20134128	1021000A	1016122A	NONE	MA1038E	NONE	1020520	K1417
1021658E	E	43196	1585-1795 (230-260)	20134126	1021000A	1016122A	NONE	MA1038E	NONE	1018528	K1418
1021658F	F	43197	2205-2760 (320-400)	20134127 20134129	1021000A	1016122A	NONE	MA1038E	NONE	1020520	K1420
1021658G	G	43198	1585-1795 (230-260)	20134128	1020542	NONE	M2051S	MA1038E	1/4" NPT	1018528	K1419
1021658H	H	43199	1585-1795 (230-260)	20134127	1021000A	NONE	M2051S	MA1185A	NONE	1018528	K1418
1021658J	J	43200	1585-1795 (230-260)	20134127	1020542	NONE	M2051S	MA1053Q	NONE	1018528	K1418

REV	DESCRIPTION	DATE	APPROVED
B	A2 ECN12561	7-28-04	
A	B3 ECN12537	6-28-04	

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN MILLIMETERS
SURFACE FINISH IN MICROMETERS
ALL DIMENSIONS TO BE ACHIEVED BEFORE PLATING OR COATING
REMOVE ALL BURRS AND SHARP EDGES

DRAWN 1020391
MODEL MG 5222DC
TWIN DISC INCORPORATE

METRIC

MATERIAL

HEAT TREAT

FINISH

VALVE ASS'Y.

DRAWN 5-04-04
SCALE FULL
CHK'D D. MEYERS
APP'D AEC
WTW 2:1 SIZE A1 SHT 1 OF 1

TWIN DISC
INCORPORATED RACINE, WISCONSIN, USA

1021658

#1021569 10/04

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